

Almost Free  
Software Catalogue  
and new software

# Computing! NOW!

Canada's Personal Computing Magazine

January 1987

\$3.75  
MM70247

## Graphics

### Special PC Graphics Software Section

- Seven Paintbox and CAD Reviews
- Graphics in C

- PC Date in Assembly Language
- Guitar and MIDI
- Macintosh Hardware Survey
- PC Accelerators

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**FREE:**  
\$395 ATI Graphics Solution Card  
with ALL BEST Computers  
Dual Function Video: Hi-Res Monochrome and Colour.  
(Substitutes regular boards). See our new catalogue  
for full specs. Time Limited Offer.

# BEST Computers

Specifications  
in our 1987  
Catalogue  
call for a free  
copy

**Made in Canada, IBM PC, XT & AT Compatible**

Monitor not included. IBM, IBM PC, IBM XT and IBM AT are registered trademarks of IBM Canada Ltd.

## Features common to BEST MK II, MK III & MK IV

- Superb IBM PC & XT Compatibility
- Canadian Made
- 256K RAM Standard minimum (uses 41256K RAM chips)
- Expandable on board to 640K RAM
- Parallel Port (for printer)
- Serial Port (for communications)
- Real Time Clock/Calendar (with Battery Backup)
- Presocketed for optional co-processor — such as 8087 Math Processor
- IBM Compatible Keyboard
- Reset Switch
- Phoenix BIOS as used in many major brand IBM compatible systems.
- 150 Watt Power Supply which will handle a Hard Drive without upgrade.
- 7 Slots
- Flip top case
- 2 Slimline DS,DD 5 1/4", 360K Disk Drives
- Colour Video (RGB & Composite) Board or Hi-Res Monochrome Card (customer choice)
- Disk Controller Board
- CSA Approved

## Warranty

We have such confidence in the reliability of the BEST that we offer a full One Year Warranty. This far exceeds the 90 day industry standard. On-site service plan is available across Canada at extra cost through 3M of Canada Ltd.

### BEST MK II.

Two 350K DS,DD disk drives, Serial and Parallel Ports, Real Time Clock, Phoenix BIOS, uses 8088 processor — full specifications given above.

**\$1695<sup>00</sup>**

ONE YEAR WARRANTY

#### Other Configurations:

With 640K RAM ..... \$1795  
With 20 Meg Hard Drive/1 Floppy/256K ... \$2495  
With 20 Meg Hard Drive/1 Floppy/640K ... \$2595

4.77/8MHz  
DUAL  
SPEED

### The FAST BEST MK III

As BEST MK II plus speed selectable: 4.77 and 8MHz (most software will run on the higher speed), uses 8088-2 processor.

**\$1895<sup>00</sup>**

ONE YEAR WARRANTY

#### Other Configurations:

With 640K RAM ..... \$1995  
With 20 Meg Hard Drive/1 Floppy/256K ... \$2695  
With 20 Meg Hard Drive/1 Floppy/640K ... \$2795  
With 80 Meg Hard Drive/1 Floppy/640K ... \$4495

ULTRA  
FAST

### SUPER-FAST BEST MK IV

As BEST MK III plus TRUE 16-Bit machine, 8086-2 processor, IBM compatible 8-Bit I/O channel bus, even faster than MK III due to 16-Bit architecture. With 640K standard.

**\$2195<sup>00</sup>**

ONE YEAR WARRANTY

#### Other Configurations:

With 20 Meg Hard Drive/1 Floppy/640K ... \$2995  
The BEST Mk IV Main board processes data approx. 2.1 times faster than the IBM PC/XT or BEST Mk II.

IBM  
AT  
Compatible

### AVT-286

Superb IBM AT compatibility, 640K RAM, Two 5.25 in disk drives (one high density 1.2 Megabyte, one standard 360K), serial and parallel ports high quality-keyboard, keyboard lock and status monitor. 16 MHz clock (8MHz CPU)

**\$3495<sup>00</sup>**

ONE YEAR WARRANTY

#### A Basic Configuration with fast stepping Hard Drives:

20 Meg Hard Drives ..... \$4795  
30 Meg Hard Drive ..... \$4995  
40 Meg Hard Drive ..... \$5495  
80 Meg Hard Drive ..... \$5995  
Built-in Tape Backup Systems from ..... \$ 799  
BEST 1200/300 Plug-in-Modem ..... \$ 249

Lightening Fast  
IBM AT com-  
patible.  
• 10 MHz CPU  
• 2Meg RAM  
• Up to 4 Meg RAM  
on Board

### AVT10-286

Superb IBM AT compatibility plus more:  
• Standard 2Meg RAM and optionally up to 4 megabytes of RAM on main board.  
• 6 MHz, 8 MHz, and 10 MHz selectable system speed  
• (2) 5 1/4" disk drives (1 high density 1.2 meg, one standard 360K)  
• Serial and parallel ports, high quality keyboard, keyboard lock and status monitor.

With 2Meg RAM and 10 MHz CPU

**\$4995<sup>00</sup>**

ONE YEAR WARRANTY

#### As Basic Configuration with fast stepping Hard Drives:

20 Meg Hard Drive ..... \$6295  
30 Meg Hard Drive ..... \$6495  
40 Meg Hard Drive ..... \$6995  
80 Meg Hard Drive ..... \$7495  
Additional 2 Megabytes RAM  
(to bring system to full 4 Megabytes) ..... \$ 995  
Built-in Tape Backup Systems from ..... \$ 799

**Exceltronix**

Toronto Store: 319 College Street, Toronto (416) 921-8941  
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6315 Kestrel Road, Mississauga, Ont., L5T 1S4  
Long Distance Orders: 1-800-387-6995, Local Orders: (416) 673-5111

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Selling MICRO COMPUTERS to small and medium size businesses can turn your skills and local knowledge into LARGE GAINS.

EXCELTRONIX, one of Canada's leading PC/XT/AT compatible makers invites those who qualify to share in the UNLIMITED REWARDS of successful selling by becoming part of its network of Independent Agents.

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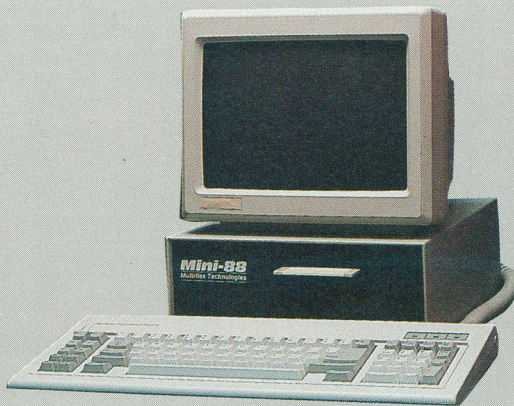
INTERESTED PERSONS can receive more information in confidence from:

Director of Special Projects Exceltronix Components & Computing Inc.  
6315 Kestrel Road, Mississauga, Ontario L5T 1S4 (416) 673-5111

Applies to most BEST and Multiflex products.

### NEW: Mini-88

What you've been waiting and asking for is now here! New Compact Portable 8088-2 Dual Speed PC/XT Compatible From **\$499**



- 8088-2 Motherboard
- 8MHz and 4.77MHz operation
- Compact case and power supply
- 256K RAM on board expandable to 640K
- 90 Day Warranty

Basic Unit as listed .....\$499.00

Basic Unit with Video Board (Colour or Hercules Compatible), Floppy Controller, Keyboard .....\$699.00

Basic Unit with Video Board (Colour or Hercules Compatible), Floppy Controller, Keyboard and Built-in 3.5" 750K Disk Drive .....\$849.00

Second 3.5" 750K Disk Drive (Built-in) .....\$159.00 extra

Basic Unit with Video Board (Colour or Hercules Compatible), Floppy Controller, Keyboard and External plug-in 360K Disk Drive .....\$849.00

Basic Unit with Video Board (Colour or Hercules Compatible), Floppy Controller, Keyboard and external plug-in Dual 360K Disk Drive package .....\$995.00

External 20 Meg Hard Drive package with controller and power supply available.

### NEW: Mini-286

At Last! A 80286 AT Compatible From Only **\$1495!**



- 16MHz clock (8MHz CPU)
- 80286 Motherboard
- 512K RAM On-Board Expandable to 640K
- Case and 150W Power Supply
- AT Compatible Keyboard
- 7 Expansion Slots
- 90 Day Warranty

Basic Configuration as listed .....\$1495.00

As Basic unit plus Video Board, Floppy Controller, and one 5.25" 360K drive .....\$1995.00

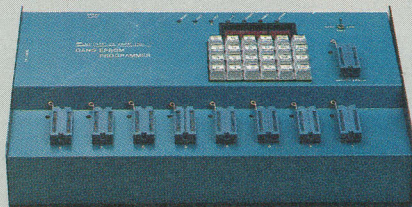
As Basic unit plus Video Board, Floppy Controller, and one 5.25" 360K drive and 20 Meg Hard Drive .....\$2995.00

Optional 1.2 Megabyte Drive for any configuration ...\$ 199.00

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6315 Kestrel Road, Mississauga, Ont., L5T 1S4  
Long Distance Orders: 1-800-387-6995, Local Orders: (416) 673-5111

## Spectacular Gang EPROM Programmer & Emulator



Totally self-contained (has its own display, entry keypad and power supply).

Based on the Z-8 microprocessor.

Can program up to 8 EPROMs simultaneously (anywhere from one to 8 EPROMs at the same time with the information in its own memory or master EPROM).

The Gang Programmer can handle a wide selection of EPROMs: 2716, 2732, 2732A, P2732A, 2532, 2764, 27128, 27128A and optionally upgradeable to handle 27256, 27512, 2758 and 2724.

Complete package with EPROM Emulator, 8 ZIF sockets, Gang Programmer with 16Kx8 of RAM and RS232. .... **\$995.00**

Gang EPROM Programmer with 8 ZIF sockets, 16Kx8 RAM and RS232, without Emulator. .... **\$695.00**

EPROM Programmer with only one ZIF socket, 16Kx8 RAM and RS232, without Emulator. Able to do all the functions describe but can handle only one EPROM at a time. .... **\$499.00**

## Zenith Monitors

### NEW

#### ZVM1220A

12in. diagonal screen - non-glare amber display • composite input • 25 lines x 40/80 characters

**\$129.00**

### NEW

#### ZVM1230A

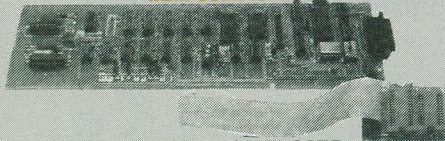
12in. diagonal screen • non-glare green display • composite input • 25 lines x 40/80 characters

**\$125.00**

**NEW ZVM 1240** • 12" diagonal screen • glare amber display • PC monochrome input (TTL) • 25 lines x 80 characters • 720 x 350 pixels • IBM PC & compatibles

**\$229.00**

## EPROM PROGRAMMER (IBM COMPATIBLE)



### MAIN EPROM PROGRAMMER CARD (WITH SOFTWARE)

With 2 standard EPROM sockets. .... **\$ 99.00**

### EPROM PROGRAMMER WITH ZIF SOCKETS (WITH SOFTWARE)

With one 24-pin ZIF socket and one 28-pin ZIF socket with provision for serial port. .... **\$139.00**

### EXTERNAL CARD

Ready to plug into the main EPROM Card (includes one 24-pin and 28-pin ZIF socket and cable). Saves you from opening the computer each time you want to program your EPROMS. .... **\$ 69.00**

### SERIAL OPTION

For your main EPROM programmer. Provides you with a second RS232 serial port. .... **\$ 29.00**

### TVM Colour Monitors

MD-3. 14in., Multi-Display, Hi-Res RGB Monitor. Includes green/amber/full colour switch. .... **\$599.00**

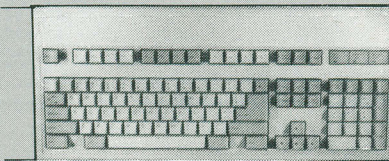
MD-3V. Multi-Function RGB Monitor/Receiver. Multi-purpose TV Mouse for VTR/TV viewing. Soft-Touch 7-colour monochrome selector and white reverse switch. .... **\$899.00**

MD-7. Multi-Scan Enhanced RGB Monitor. Compatible with IBM EGA cards. Dual mode 15.75 to 21.85 KHz, 640x200 to 720x350 pixels. Green/amber/16 to 64 colours. .... **\$899.00**

## Keyboards:

Maxiswitch (similar to 5150)

XT/AT compatible. .... **\$129.00**



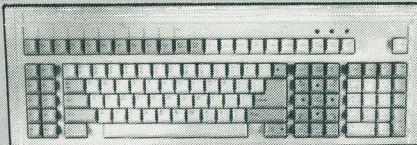
### Maxiswitch Memory Pro

20 Function keys. Programmable giving user incredible flexibility. .... **\$299.00**

### Maxiswitch ME101

At enhanced keyboard. 12 function keys. (similar to 5151). XT/AT compatible.

**\$179.00**



### The BEST EGA - Enhanced Graphics Adapter

The BEST EGA card has several modes of video operation available on one card. 100% IBM EGA compatible. 640 x 350 pixels in 16 colours on the enhanced colour display.

It supports functions of the IBM Colour graphics video adaptor and IBM monochrome display adaptor. 320 x 200 and 640 x 200 16 colour graphics on the colour graphics monitor; 640 x 350 four shade graphics on the monochrome display (black, normal, intensified and blank); flicker free display; split alphanumeric mode screen display; bit mapped graphics in four planes; up to 512 characters that can be user defined.

The BEST EGA card comes standard with 256K memory for flicker free, text and bit mapped graphics. **\$299.00**

### The BEST IBM AT Compatible 4 Meg Memory Card

In order to take advantage of the memory addressing capabilities of the IBM AT or the BEST ANT-286 business computer, we developed a memory card to give the user up to 4 Megabytes of dynamic RAM. The memory card will run at speeds up to 16MHz, which is fast enough to meet the needs of any 80286 microprocessor on the market today. The design uses state-of-the-art (256K x 9) memory arrays, to allow for maximum memory in the smallest physical space. The ninth bit is used as a parity bit to insure the validity of the data. The card is available in memory sizes from 512K to 4 Megabytes in steps of 512K. Boundaries are switch selectable above 1 Meg in blocks of 512K.

With 512K Regular. .... **\$ 895.00** Special. .... **\$349.00**  
With 1 Meg Regular. .... **\$ 895.00** Special. .... **\$499.00**  
With 2 Meg. .... **\$ 759.00** Special. .... **\$ 759.00**  
With 4 Meg Regular. .... **\$1995.00** Special. .... **\$1295.00**

### Memory and Parts

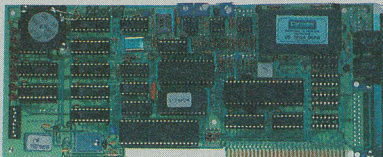
4164 (150ns)	\$ 1.99
41256 (150ns)	\$ 4.95
(quantity discounts available)	
2764	\$ 5.95
27128	\$ 5.99
27256	\$ 6.95
6116	\$ 3.69
6264	\$ 6.20
V20 (5MHz)	\$ 13.00
V20 (8MHz)	\$ 18.00
SP0256 (sound chip)	\$ 25.00
8087	\$245.00
90287	\$450.00

## BEST MODEM

The BEST modem is a smart 1200/300 direct connect modem. It can either be a stand-alone unit in which case it requires a small wall adaptor, or it plugs in one of the IBM slots. When used as a stand-alone unit, the modem looks like a Hayes 1200 Smart Modem, that is, it emulates the same instruction set. When it is used in the IBM, it looks like an intelligent serial communications port which also supports a super-set of the Hayes instruction set.

The modem supports auto-dial, auto-answer, and auto-speed select directly from software control. The modem also has a speaker so that aural monitoring of the call is possible. There are also LED monitors so that the state of the modem can always be known. These LEDs are: Modem Ready, Auto-Answer enabled, Carrier Detected, Transmitting, Receiving, Data Set ready.

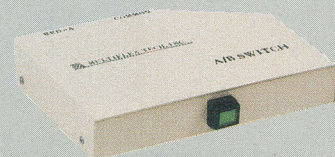
Software packages such as Crosstalk, PC-talk and Hayes' Smartcom II also will run with this modem.



300/1200 Baud. .... **\$249.00**

300/1200 Baud, Stand-Alone Unit, Attractively Packaged. .... **\$299.00**

## Switch Box \$59.00



Contains 3 RS232 connectors and a switch which switches all lines between input and one of two outputs.

## DISK DRIVES

### NEW SILENT JU455 Shugart/Panasonic

5.25" slimline DS/DD Disk Drive with 360K

Ideal for IBM Computers. .... **\$149.00**

### JU475 Shugart/Panasonic

5.25" slimline Disk Drive with 1.2Meg

Ideal for AT Compatibles. .... **\$199.00**

### Hard Drives

Seagate 20 Meg with controller. .... **\$799.00**

Special: Toshiba 80Meg hard drive with controller. .... **\$2495.00**

### AT Compatible

High Speed Seagate Hard Drives with controller

20Meg. .... **\$1295.00**

30Meg. .... **\$1495.00**

40Meg. .... **\$1995.00**

## Call or Write for our Full Colour Catalogue

Our 1987 catalogue gives full specifications on our IBM AT and XT compatible computers plus detailed specifications and prices on our other products. Also ask for our New Parts Flyer.

## Copal Printers

• Epson Compatible • Supports both IBM and Apple systems • Centronics Parallel Interface • Both Draft and Near Letter Quality (NLQ) modes

### SC1200

• 120 cps draft quality  
• 24 cps NLQ  
• NLQ available in all print sizes

### \$329.00

• 11 inch carriage  
• Pin and friction feeds  
• One Year Warranty

### SC1500 \$499.00

• 180 cps draft quality  
• 36 cps NLQ  
• 3K Buffer

### SC3500 \$699.00

• 15 inch carriage  
• 3K Buffer



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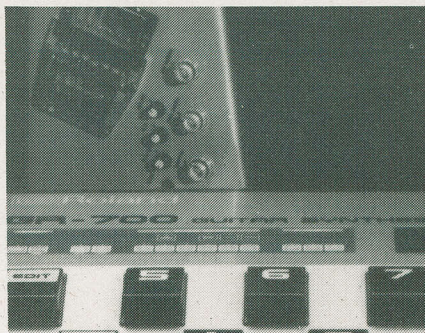
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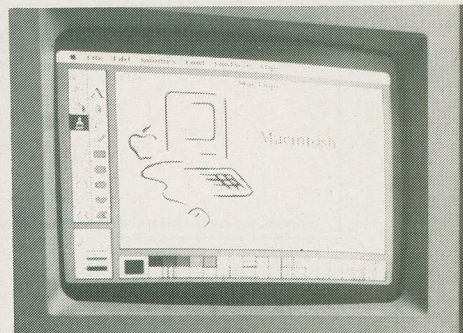
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Due to limitations of space, a few of our PC paintbox reviews have been held over until the next edition of Computing Now!



40

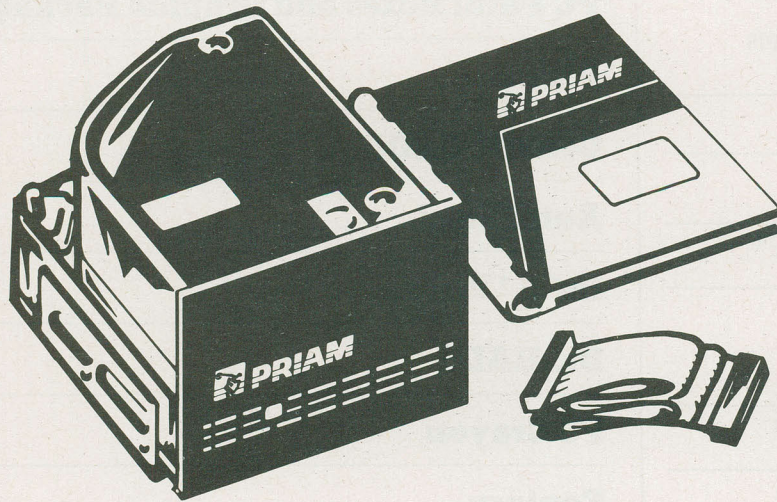


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# The Fastest, Finest Hard Disk for the IBM PC Family.



## PRIAM InnerSpace™

- 40, 60, 90, or 130 MBytes for your IBM PC, XT, AT, or Compatible
- Fastest Winchester available
- Shock mounts and automatic head locks for extra security
- Full one year warranty
- Complete, step-by-step kit installs in 10 minutes
- From **PRIAM**, the leading U.S. manufacturer of high performance Winchester disk drives
- Average access as fast as 14.6 ms

**PRIAM** The name for quality and reliability in disk drives, storage systems and tape back-up.

InnerSpace is a trademark and PRIAM a registered trademark of PRIAM Corporation. IBM, PC, XT, and AT are registered trademarks of International Business Machines Corp.

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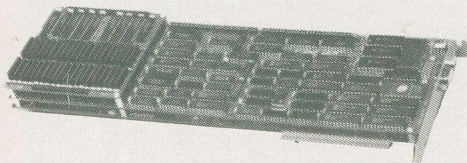
Circle No. 4 on Reader Service Card

# COMPUTER PRESS

by Marie Hubbs

## Great Graphics Goodies

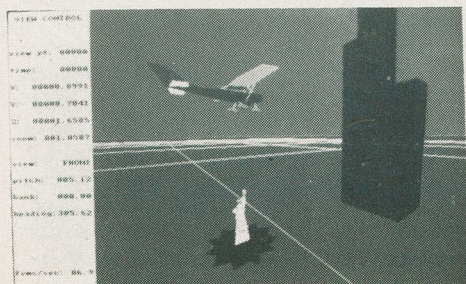
● The professional graphics controller, CAD-card Model 1040 from *Intelligent Graphics*, reportedly delivers twice the performance of the IBM PGC. Featuring an 80186 CPU, the graphics accelerator increases drawing speed to twenty-five thousand vectors per second, and costs \$1,750 US. For local dealers and Canadian prices, contact Bill McDonough of McDonough Communications, 2680 Bayshore Frontage Road, Mountain View, California 94043, (415) 968-1353.



● *Summagraphics* has announced that several of its IBM PC compatible graphics tablets will support **Microsoft's Windows** operating environment, including SummaSketch and Professional Series. The software driver, developed by Softstyle, will also be available through Microsoft dealers. You can get more information from the Product Manager, Summagraphics, 777 State Street Extension, Fairfield, Connecticut 06430, telephone (203) 384-1344.



● *SubLOGIC* has released the IB-3D1 3D Graphics Package for the IBM PCs and compatibles. Containing a complete set of programs for the creation and real-time animation of 3D objects, the package includes a high-speed assembler/linker and a digitizer/plotter interface, as well as the graphics drivers behind the Flight Simulator programs. Priced at just under one thousand dollars American, it's published by SubLOGIC Corporation, 713 Edgebrook Drive, Champaign, Illinois 61820, telephone (217) 359-8482.



● Based on the 80386 processor, the T8 single-board graphics system for IBM/ATs, PC/RTs and compatibles provides 1280 by 1024 pixel resolution on eight-plane 60 Hz non-interlaced displays. Including a complete microcode-based CGI graphics library and CGA and EGA emulation, it costs \$4,500 US, and is available from the manufacturer, *Microfield Graphics*, 8285 South West Nimbus Avenue, Suite 161, Beaverton, Oregon 97005, telephone (503) 626-9393.

## Quaid Upgrade

A new version of the disk utility **Disk Explorer** from *Quaid Software* includes an automatic mode as well as the old manual file recovery method, has a new manual, and is easy enough for a novice to use. The new version will be \$105 plus Ontario sales tax, and owners of older versions can trade up with an additional \$24.

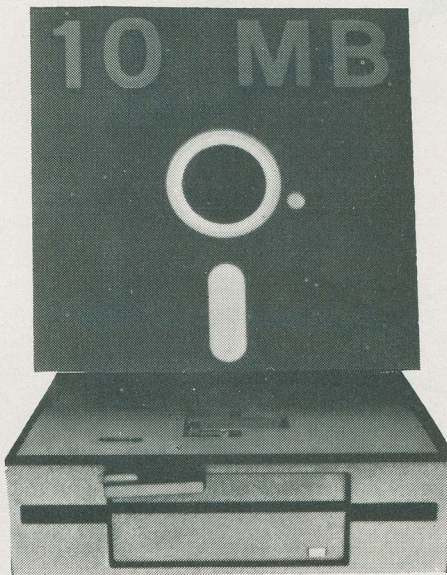
Send your old disk and money to Quaid Software, 45 Charles Street East, Third Floor, Toronto, Ontario M4Y 1S2, or call them at (416) 961-8243.

Circle No. 26 on Reader Service Card

## Fat Floppies

*Konica Technology* has developed a ten megabyte, five and a quarter inch floppy disk drive system, which reads and writes data to a track density of 480 TPI. The half-height drives can also read from 360K and 1.2 Mb standard floppies. Sample units will be available to OEMs and VARs early in '87, at a price to be established later.

For more information, pricing and local availability, contact Konica Technology, 777 North Pastoria Avenue, Sunnyvale, California 94086-2918, or phone (408) 773-9551.



Continued on Page 34

Next Month  
In

**Computing Now!**  
Canada's Personal Computing Magazine

## User Friendly Systems

In the next edition of *Computing Now!* we'll be having a detailed look at the state of the Macintosh, the Amiga and the Atari ST. Included in this will be an overview of the software and peripherals that are available for these systems, their capabilities and a realistic evaluation of their usefulness for various applications.

## McPoker

Next month we'll be having a peek at a C program that plays draw poker on the Mac. As well as being a fairly slick game, this application uses a lot of the Mac's more complicated internal routines, making it a useful example of programming techniques in one of the really weird operating systems of this century.

## Laser Printers

The toy of the gods, the output device of kings and the nexus of a number of powerful business applications, laser printers are the ultimate manifestation of micro-computer hard copy. However, there are rather a lot of them. In the next *Computing Now!* we'll be checking out what's available and where to get it.

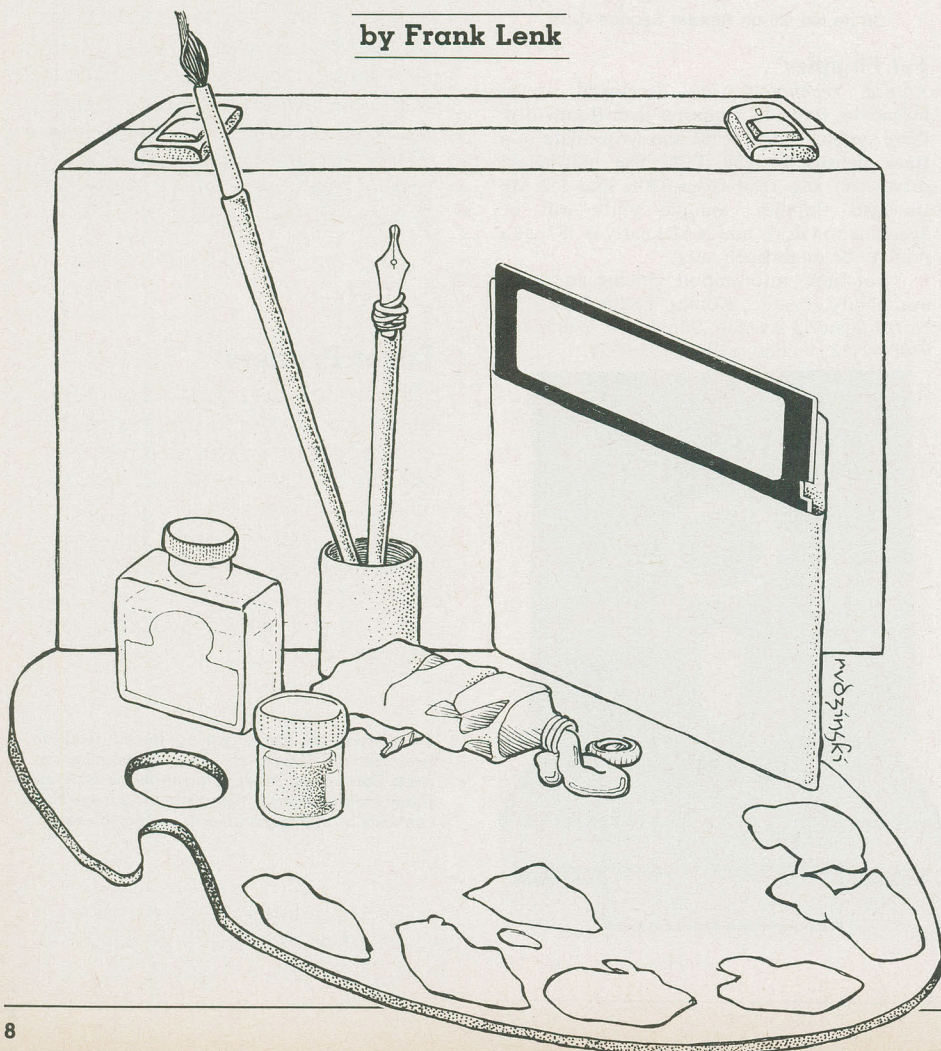
These features are in an advanced state of preparation. However, in endeavouring to keep *Computing Now!* as up to the minute as possible we reserve the right to change the contents of this issue prior to going to press.

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# PC Paint Boxes

Once the sole province of the Macintosh, the ability to create and manipulate graphics on the PC seems to be coming of age.

by Frank Lenk



The nice thing about the PC is that the software choices are so broad. You can get any conceivable type of program, in almost any conceivable flavour. The trick is finding your way around in this vast candy store of applications.

There are plenty of graphics programs available for the PC, but they can be crudely divided into three categories... pixel oriented paint programs, object oriented CAD programs, and character based publishing programs. What follows is a quick reference guide to the major options in each category.

An important thing to remember as you go along is the large degree of overlap between these software categories. Most paint systems offer advanced text features, while the font or publishing systems inevitably offer many excellent drawing features. Some paint programs are easier to use for dimensioned technical drawings than your average low cost CAD system. On the other hand, some purportedly technical drawing programs can create nicer artwork than most paint programs. I'll try to point out the major overlaps as I go, but remember to keep an open mind.

## Bucket And Brush

Graphics software is usually synonymous with one particular type of program... pixel oriented paint systems. The archetypal package in the genre is MacPaint... available only on that odd little box marketed by the company that's named after a fruit. The success of MacPaint has not been lost on PC software developers, and now even PC-DOS boffins have a good selection of paint software to choose from.

Of the PC software I've seen, one paint program stands out head and shoulders above the rest... Dr HALO, from Media Cybernetics. Dr HALO has just about every feature your heart could desire, works fast and supports almost every conceivable combination of input and output hardware. HALO DPE... the "desktop publishing editor", adds some text oriented features, including support for full page laser printer graphics.

One of the biggest names in paint software is PC Paintbrush, from ZSoft. Unfortunately, this popular package was undergoing a major upgrade just as we were putting together this issue, so I didn't get hold of a copy in time to review it. However, the new PC Paintbrush Plus will very likely be worth waiting for.

One of the nicest pixel based systems I've seen is a shareware program, PC-Key-Draw, from OEDware. PC-Key-Draw goes way beyond the usual paint functions with CAD features like layering, an enormous virtual drawing page, macro programming, fillets and so on. The user interface is a bit unusual, but includes a pop up menu and lots of prompts. The program's designer...

Edward Kidera IV... created the system to help with both his own engineering work and with his wife's creative art background. The resulting software is a pot full of fun. It's always nice to be able to support the freeware folks, in any case.

Show Partner, from Brightbill-Roberts, includes a very usable graphics editor. However, the main purpose of the system is the creation of slide show animations. If you're the least bit interested in that kind of standalone presentation, this system will be a major hit. The graphics editor, by the way, offers the unusual advantage of running as a resident utility, allowing you to capture screens from most other applications software and then dress them up to suit yourself.

PCcrayon, from PCsoftware, is just barely worth looking at... but strictly for laughs. If you aren't all that serious about graphics and just want something to let you play around a bit, PCcrayon might work out. Just don't spend too much money on it.

Magic Key/Pad and Magic Symbol/Pad... from Toronto's own PC Magic... are truly peculiar programs. I'm not really sure who would get the best use out of them. The pictorial results seem like they might be fun for kids, but the user interface is bound to baffle them. Still, if you're keen on symbol based graphics, and would like to support the domestic software industry... give them a try.

A peculiar... but workable... approach to pixel painting is taken by Diagraph, from Computer Support Group. Using a vast library of vector based clip art images, its users can quickly paste up slick presentations without ever doing any actual drawing themselves. Diagraph is obviously slanted heavily toward ten thumbled business executives, and should serve this group admirably. The program could actually have a much wider appeal, but its high price, hardware hungeriness and copy protection will probably keep it out of the home market.

The two big font programs... Fontrix and Fantasy... both offer significant paint capability. Fontrix lacks only an arbitrary pattern fill, but can create filled rectangles. Fantasy isn't quite as good at displaying cursor co-ordinates, but could easily take over from most paint programs.

The low end CAD systems don't really impinge on the paint category, mainly because they are much more difficult to use for a given type of results. They also usually omit key features such as pattern fill and support for adjustable brush widths and shapes.

### Drafting And CAD

The choices in CAD have been expanding at a splendid pace of late. Where once you had to spend several thousand dollars to acquire something like AutoCAD, now there are several excellent alternatives priced at

no more than several hundred dollars each.

Even AutoDesk itself has gotten into the act, bringing the price of its AutoCAD base system down into this range, and introducing an entirely new entry level package, AutoSketch... of which more anon. The new low price for AutoCAD is, of course, largely an illusion. For a few hundred bucks you get a very bare bones system. You'll still shell out four figure amounts to add all the advanced options.

Probably the first application to break the CAD price barrier was ProDesign, from American Small Business Computers. Although no longer the cheapest full featured CAD system available, ProDesign remains "the one to beat". None of the systems I've looked at had *all* the features I'd have liked, and so too ProDesign lacks some of the tricks invoked by its competitors. Still, the program provides an excellent balance... including all the standard capabilities up to and including spline curves, plus some handy but less frequently seen features such as hatching, fillets, auto dimensioning, area calculation and others.

ProDesign also includes excellent dot matrix support as standard equipment. Plotter quality images can be created using the quad density mode of Epson type printers. An AutoCAD file exchange utility is about the only thing you need to buy separately.

Several newer packages have come along, offering considerably lower prices. Each of these has its good points, and all of them are decent things to use. Unfortunately, it appears that these very new, very low cost programs still have a few rough edges... particularly as far as reliability and interfacing are concerned. This is probably inevitable, and should be taken care of by a few more months' worth of shaking down in the streets. Provided that their publishers continue to support these packages, there is no reason to exclude them from consideration as serious drafting tools. Just make sure that you buy them from someone who can support you through the interim.

AutoDesk's own solution to the entry level CAD situation... AutoSketch... is an odd little effort. It looks like a paint program, but includes piles of real CAD features. The combination of friendly interface and heavy functionality may be better suited to users who need a sort of all round drawing utensil, rather than a low end CAD program. Still, there's nothing stopping you from using AutoSketch for "real" CAD. The auto dimensioning function stands out as perhaps the nicest single feature I've seen in any CAD program.

If what you want is a real AutoCAD lookalike, Generic CADD is probably the more natural choice. CADD comes across more like a genuine CAD system, although it actually doesn't offer all that much more in the way of CAD functions. After all, there are only so many ways to draw boxes, lines

and circles. However, a major advantage of CADD is that it provides a command driven interface... in addition to AutoCAD style nested menus. This makes it easy to learn, easy to use... and programmable. On the negative side, Generic CADD involves a bit more money than AutoSketch, and its dot matrix support package is an optional extra.

The real oddball in CAD software is In\*a\*Vision, from Micrografx. This program is so different, it's a toss up whether or not it should even be called CAD. However, it is vector and object... rather than pixel... based, and it does include traditional CAD features such as layering, symbol libraries and dimensioning.

In\*a\*Vision also includes paint functions such as pattern fill. The resulting mix comes across much like "draw" programs... MacDraw and GEM Draw being the most notable examples. In\*a\*Vision can certainly handle CAD drafting tasks, but would probably be an even more natural choice for business oriented work like organizational tables or graphic presentations. The price is a good deal higher than either Generic CADD or AutoSketch, but then you do seem to get a rather unique kind of power for the money. Its dot matrix support is tremendous, and its processing speed is unusually brisk for this kind of program.

If you are shopping around for a cheap CAD package, the best advice would be to stop for a moment and seriously consider if that's *really* what you want. A good pixel oriented paint system like HALO DPE will do most basic drawing work a whole lot faster and more painlessly than most CAD programs. CAD really shines only on complex, detailed jobs when it's run on properly configured hardware... preferably AT level, with a math coprocessor and a hard drive.

If you really do need CAD, reconsider going first class... pry open your wallet and shell out top dollars for top notch software and hardware. The expense may hurt, but it's not nearly as painful in the long run as trying to do a real professional job with amateur's tools.

If you must go the low cost route, any of the three systems I've looked at will serve... each in its own way. ProDesign is well proven and reliable, although a bit harder to learn than the others. AutoSketch is dead easy to use, but not as flexible as Generic CADD. If you can afford just a *bit* more money... and maybe have slightly wider requirements than technical line drawing... take the time to look carefully at In\*a\*Vision.

### Fit To Print

There's been a lot of fooforaw of late about something called "desktop publishing". Unless you have a lot of money to spend, this presumptuous term should be treated with the same reserved skepticism formerly accorded the words "artificial intelligence".

## PC Paint Boxes

Artificial intelligence only looks intelligent when implemented on megabuck hardware and when compared with dismally stupid "real" intelligence. Similarly, desktop publishing is a reality for most of us only if our needs are limited and our pockets deep. Somewhere there are folks turning out novels on intelligent publishing systems... combining fancy fonts, complex formats, even photo quality graphics, previewing the whole works on an ultra high resolution monitor and dumping it all out to a twelve hundred dot per inch typesetting machine. I don't know any of them.

Most of us can't afford a laser printer as yet. Fortunately, the software publishers have taken up the slack. There are at least a few packages around that can offer much of the fun and function of real publishing systems, but at a fraction of the cost and with modest hardware requirements.

The grandfather of all the low end publishing systems is not itself a publishing program at all. Fontrix, from Data Transforms, actually grew up on the Apple II as a sort of combination graphics and pretty printing utility. Ported upward to the PC, Fontrix began to take on a new aspect, until it was quite capable of producing full

pages of graphics and text, at a resolution acceptable for most purposes.

Although Fontrix is able to engulf and format text files, Data Transforms recently introduced a separate product... Printrix... to extend the text formatting capabilities of the system. Although Printrix is a moderately powerful publishing program, it lacks any onscreen previewing, making it a bit harder to use than some of its newer competitors.

Coming up from behind, several products have been yapping at Fontrix' heels like a pack of wolves. The closest competitor is a thing called Fontasy from ProSoft. Fontasy resembles Fontrix almost closely enough to be called a clone. Although the user interface is quite different, Fontasy is based on the same simple, attractive idea of placing bit mapped text on a graphics screen. However, the newer program has been built from the ground up to support text file formatting.

Encroaching on this same fancy text market from the opposite direction is Personal Publisher, distributed by Software Publishing. Rather than being a scaled up graphics paint program, Personal Publisher is sort of a scaled down publishing system. Personal Publisher is heavily oriented toward allowing PC users to take advantage

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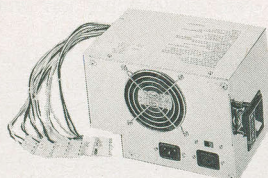
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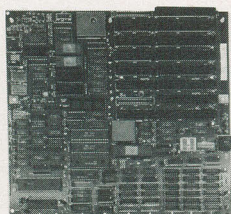
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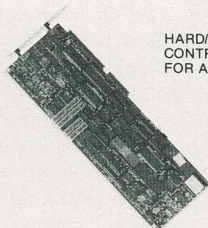
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**Software:** ProDesign II  
**System:** IBM PC  
**Application:** CAD, drafting  
**Manufacturer:** American Small Business Computers, 118 South Mill Street, Pryor, Oklahoma 74361, (918) 825-4844  
**Price:** \$299.00 US; \$99.00 US extra for AutoCAD file exchange utility.

**Software:** Fontrix, Printrix  
**System:** IBM PC  
**Application:** Personal publishing, drawing  
**Manufacturer:** Data Transforms, 616 Washington Street, Denver, Colorado 80203, (303) 832-1501  
**Price:** \$155 US Fontrix; \$165 US Printrix

**Software:** PC-Key-Draw  
**System:** IBM PC  
**Application:** Technical drawing, artwork  
**Manufacturer:** OEDware, P.O. Box 595, Columbia, Maryland 21045-0595, (301) 997-9333  
**Price:** \$100 US shareware donation

**Software:** Clickart Personal Publisher  
**System:** IBM PC  
**Application:** Desktop publishing  
**Manufacturer:** Software Publishing, 1901 Landings Drive, P.O. Box 7210, Mountain View, California 94039-7210, (415) 962-8910  
**Price:** \$185 US

Most of the other software mentioned in this article is reviewed elsewhere in this issue, or will appear in an upcoming issue.

# PC GRAPHICS PACKAGES

	Fonts	Font Editor	Text Files	Fill	Fat Bits	Virtual Page
<u>Dr HALO</u>	Yes	No	Yes (no justify)	Yes	Yes	Yes
<u>PC Crayon</u>	Yes	No	No	Yes	No	No
<u>PC-Key-Draw</u>	Yes	No	Yes	Yes	Yes	Yes
<u>Show Partner</u>	Yes	No	No	Yes	Yes	No
<u>Fontasy</u>	Yes (many)	Optional (but good)	Yes	Yes	No	Yes
<u>Fontrix</u>	Yes (many)	Yes	Yes (with Printrix)	No	No	Yes
<u>Personal Publisher</u>	Yes (many)	No	Yes	No	No	Yes
<u>Diagraph</u>	Yes	No	No	Yes	No	Yes
<u>Magic Keypad</u>	Yes	Yes	No	Yes	No	No
<u>Autosketch</u>	Yes	No	No	No	Yes (zoom)	Yes
<u>Generic CADD</u>	Yes	Yes	No	No	Yes (zoom)	Yes
<u>In*a*Vision</u>	Yes	No	No	Yes	Yes (zoom)	Yes
<u>ProDesign</u>	Yes	No	No	Yes	Yes (zoom)	Yes

This brief analysis is intended to show only a few of the typical features to be found in graphics software. The table doesn't try to judge the various packages in absolute terms. However, it should help categorize them.

( Table designed using *Fontasy* and printed on Panasonic 1091 dot-matrix. )

## PC Paint Boxes

of existing clip art and fonts available on the Macintosh. The software is a bit light on graphics features like freehand drawing, but comparatively sophisticated about text formatting. It isn't as easy to use as Fontrix or Fantasy, but is supported by a huge library of artwork and fonts... courtesy of the Macintosh community.

Personal Publisher has two major drawbacks compared to simpler pixel based programs like Fontrix and Fantasy... size and speed. Using Personal Publisher effectively requires both an AT level computer and a hard disk. You can get by on floppies, but the lethargic control response is frustrating enough to make the system almost unusable. Furthermore, the Personal Publisher display is designed so as to give correct proportioning only on a Hercules compatible display adapter.

Coming into the fray sideways, as it were, is HALO DPE... evolved from a pure paint program to include strong text handling features. DPE can read text files, but does no formatting, like justification or multiple columns.

DPE includes an advanced type of font scaling. Using some sort of vector based font, the program can enter text at any size while maintaining the optimum pixel resolution. None of the other programs I've seen have this capability. Unfortunately, the selection of fonts available for HALO is

presently rather limited. HALO DPE supports colour... including exotic hardware such as the Number Nine Revolution multi-million colour board. It also handles enormous virtual pages... given enough memory... that allow full page graphics on many laser printers.

At this point, Fontrix has fallen somewhat out of the running for personal publishing, although it remains an excellent product. However, Fontrix... like HALO DPE... does support colour printing. It is also the only package that places no limits on the size of your virtual page, automatically breaking huge areas across multiple printer pages. Printrix is a good formatting package, but suffers from the lack of previewing and the poor integration with Fontrix. Thus Printrix is capable of setting up a page of text, but can include only complete graphic files... at print time... with no subsequent opportunity for editing.

Fantasy is probably the winning package at the moment. The text formatting is simple and powerful, and the graphic functions are complete and well integrated. Additionally, Fantasy is much cheaper than either Fontrix... even without the Printrix module... or Personal Publisher. Fantasy does not include a font editor as part of the basic system, as does Fontrix. However, the optional Fantasy editor seems much more powerful than the simple pixel by pixel

editor in Fontrix.

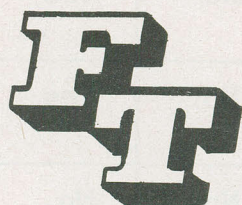
Data Transforms is striking back, with a major upgrade of Fontrix already in the works. One feature to be added is font scaling, which could compete with the present abilities offered only by HALO DPE.

If you are looking at publishing tasks such as making up single page posters, fliers or greeting cards, you'll find that HALO DPE, Fontrix or Fantasy will do the trick. At the moment, Fantasy pulls way ahead on more advanced formatting tasks, and should be more than adequate for publishing tasks such as multiple page newsletters. Personal Publisher... provided you have the right hardware... is at least as powerful with text, but weak on graphics. It would be the best choice mainly for those with a need for... and access to... artwork and fonts designed for the Macintosh.

HALO... oddly enough... has the sharpest looking text. It's relatively short on text formatting, but just the ticket if you want to create flashy graphics to go with your words.

### Forewarned And Forearmed

This summary can't hope to mention every single program available out there. However, I believe that it does cover most of the major choices in each area. If you do turn up a package that isn't included here, you'll at least know what to rate it against. **CN!**



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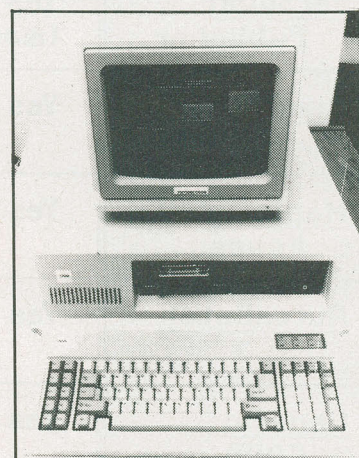
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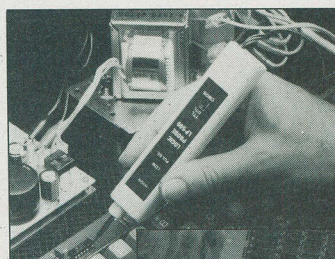
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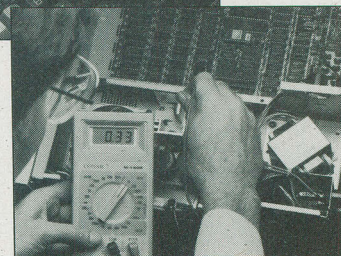
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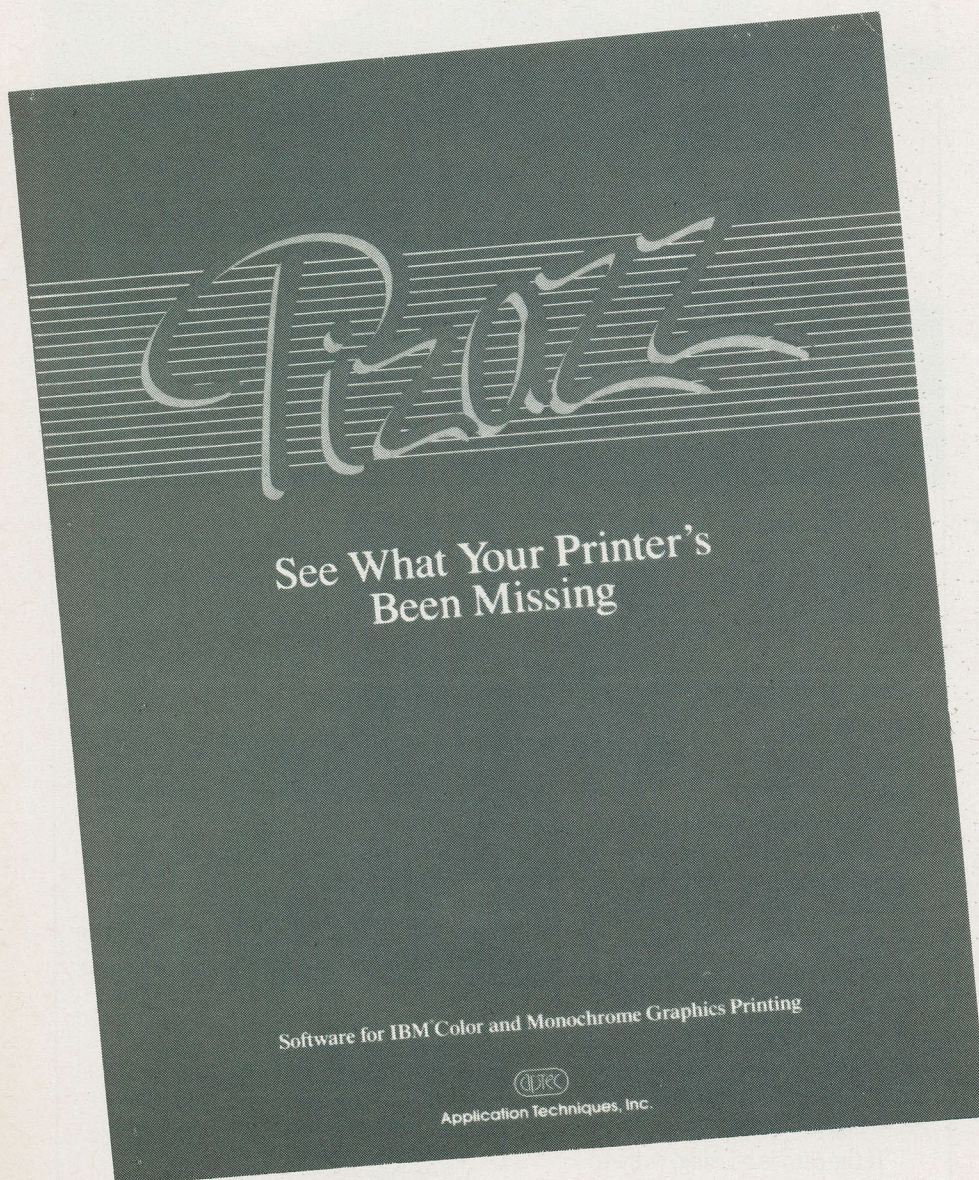
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# The Pizazz Review

by Frank Lenk



**P**izazz, from Application Techniques, is not exactly a graphics program, but it falls close enough to that category to be included here. It turns out to be a perfect complement to a lot of the graphics software we've been looking at.

Pizazz is a co-resident utility with the sole function of mediating between other software and your output device. Pizazz is particularly adept at handling difficult combinations, such as colour graphics dumps. In this sense, it is a replacement for the graphics printer driver IBM supplies on the DOS master disk, under the imaginative title GRAPHICS.COM.

Most of the screen images accompanying the reviews in this issue were generated using Pizazz... and could not have been done in any other way. Similarly, much of the work I did with colour printers simply wouldn't have got done without a little Pizazz.

The usefulness of Pizazz is that it allows one to bypass the normal routes of printer output, and generate high quality dumps of exactly what is on your screen. Thus, the program is a perfect aid to software reviewers... like myself... or to others who seek to document what's been passing across their monitors. It can also serve as a short cut for those cases where no other easy route of getting output is available... for instance, if you happen to be using an odd application program, or an unusual printer.

## Zap


To start up Pizazz, you must first configure it. The setup utility includes a menu of almost one hundred and twenty supported printers. If you can't find your printer on that menu, you must have built it yourself.

Once you finish telling it about things like your display adapter and printer port, the install program creates a series of working files on whatever disk drive you select. To load Pizazz, type *pz*. To activate it, use the normal shift *prtsc* combination. Instead of instantly activating your printer, this will pop up a full screen menu. That's where the fun begins.

The Pizazz menu works much along the standard Lotus scheme. There are two lines of primary options at the top of the screen. One can cursor a highlighted bar to any of these, or simply type the first letter of the option. If you use the cursor method, a third line provides expanded descriptions of the menu items as the highlight sweeps across them. Most of the command options will bring up a secondary menu... and in most cases a whole new screenful of informative prompts.

Some of the options are obvious. For instance, *copies* sets the number of copies to print. *Top* resets the printer's top of form mark. *Rotate* allows you to print either

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Unicalc also gives you new flexibility in window management. The window environment includes sizing and repositioning; vertical and horizontal scroll bars; page up, page down, page left and page right designators; close window designators; and pull down menus.

Because of its sparse matrix technology, Lattice's Unicalc has a jumbo-size memory—at least twice as large as other Amiga spreadsheets. And the memory is used dynamically: the greater the memory, the larger the spreadsheet.

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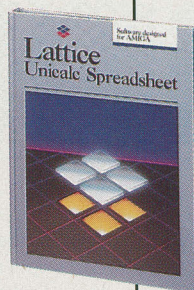
What's more, this software package allows you to escape

to CLI to perform AmigaDos functions.

Other outstanding features include: DIF, a file format which permits you to import and export your save files from other spreadsheets; Foreign Language versions; plus HIDE cell capability which allows you to hide a single cell, column of cells or a row of cells from the screen display.

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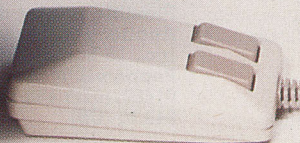
Despite all its features, Unicalc is the lowest cost spreadsheet for your Amiga PC—only \$79.95. And a complete template pack is available for just \$39.95. So, you can get the whole package for only \$119.90. With that kind of performance and price, you'll agree that Lattice has just built a better mousetrap for your mouse driven Amiga PC.



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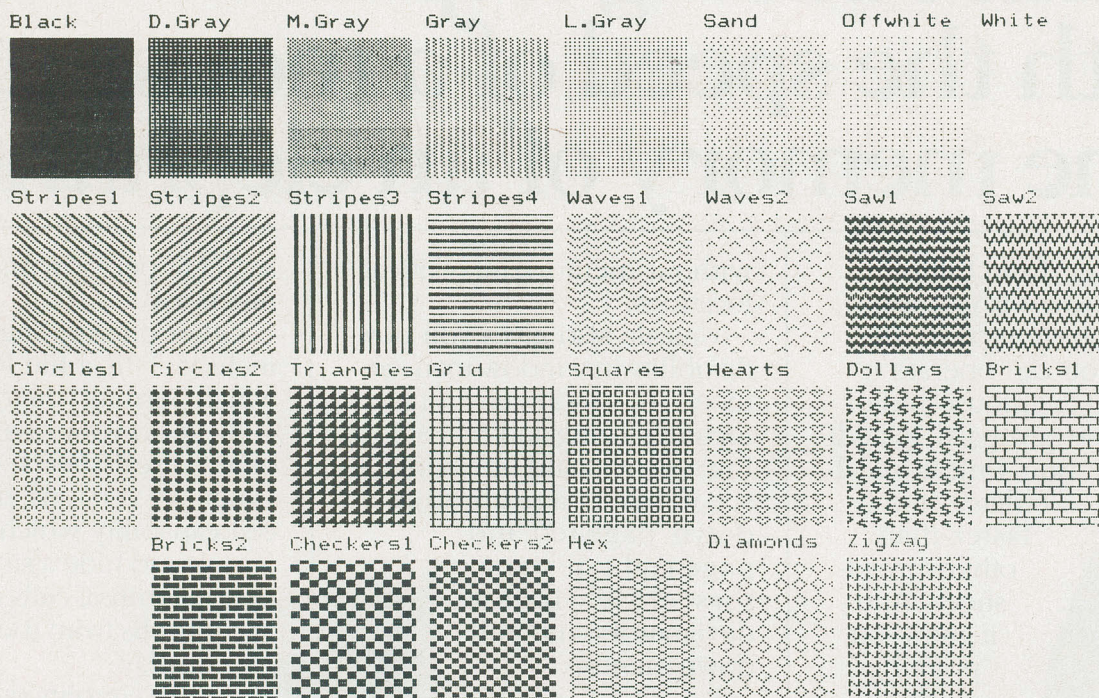
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**Circle No. 42 on Reader Service Card**

## The Pizazz Review



horizontally or vertically on your page. *Indent* sets indentation... which normally defaults to automatic mode. *Density* lets you print at low, medium or high density.

Other options provide more interesting possibilities. The *colour* function lets you map any screen colour onto any printer colour... or pattern. You can even create your own patterns. A separate utility comes with Pizazz to print out a chart of the available patterns at each of the three print densities. You can use the colour functions to get workable black and white renditions of a colour screen, or to generate an incredible range of colour mixtures on a colour printer.

The *smooth* function attempts to eliminate the jaggedness you normally get when printing low resolution displays, or when printing any material at a high magnification. I couldn't see any result from using smoothing on my Epson compatible dot matrix, so I called Application Techniques. They informed me that smoothing is most visible only on very high resolution devices, such as laser printers. To avoid destroying actual print detail, Pizazz does only a "one pixel" smoothing calculation around dark areas. Smoothing slows printing down drastically, so it's best to leave it in its default disabled state unless you come up with a situation that can really show some benefit from it.

The *divide* option allows you to crop the screen image and print only a part of it. You are shown the screen itself, and allowed to position a flashing box over the part you want.

The *width* and *height* options work

together to let you finely adjust the size of your printed image. You can set either or both of these dimensions manually, or you can select one and have Pizazz automatically scale the other to maintain proper image proportions. Unlike other printer dumps, Pizazz "dithers" the image, so that scaling is available in fractional sizes.

The *settings* menu provides a means for you to save all your current printing parameters. Pizazz normally saves these under the name PZ.PZS, which it will seek out and load automatically when you first invoke it. However, you can also specify your own names for settings files. Using the settings command you can display a menu of

available files and load whichever you wish. This lets you have preset configurations for various purposes.

Most of the Pizazz menu screen is in fact devoted to displaying the currently active print settings, so you can see at a glance just what you're getting yourself into.

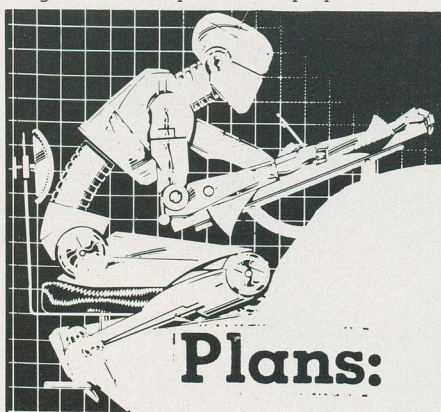
The *print* command has several sub options of its own. Of course, you can simply print the screen. However, you can also choose to save the screen and all the current Pizazz settings to a file, which you can pull up and print at some later date... using the *print transfer* option.

If all this is too complicated, you can even opt to bypass the Pizazz driver entirely. Pizazz will pass control of the printing process back to whatever driver was previously loaded.

Pizazz is great at printing "difficult" screen images, like displays from programs that use the Macintosh standard black on white text. Without Pizazz, that kind of display will generate huge areas of solid black, frying your print head and ribbon in the process. Pizazz is also excellent on colour support, since it lets you define your own colours, and excellent for dumping text screens exactly as they appear on your monitor, complete with coloured text and any otherwise hard to print graphic characters. There's even a command line option that lets Pizazz access the shift *prtsc* keycode from within programs that like to disable it.

All told, Pizazz is a software reviewer's dream... and is something that anyone with tricky printing demands should seriously consider.

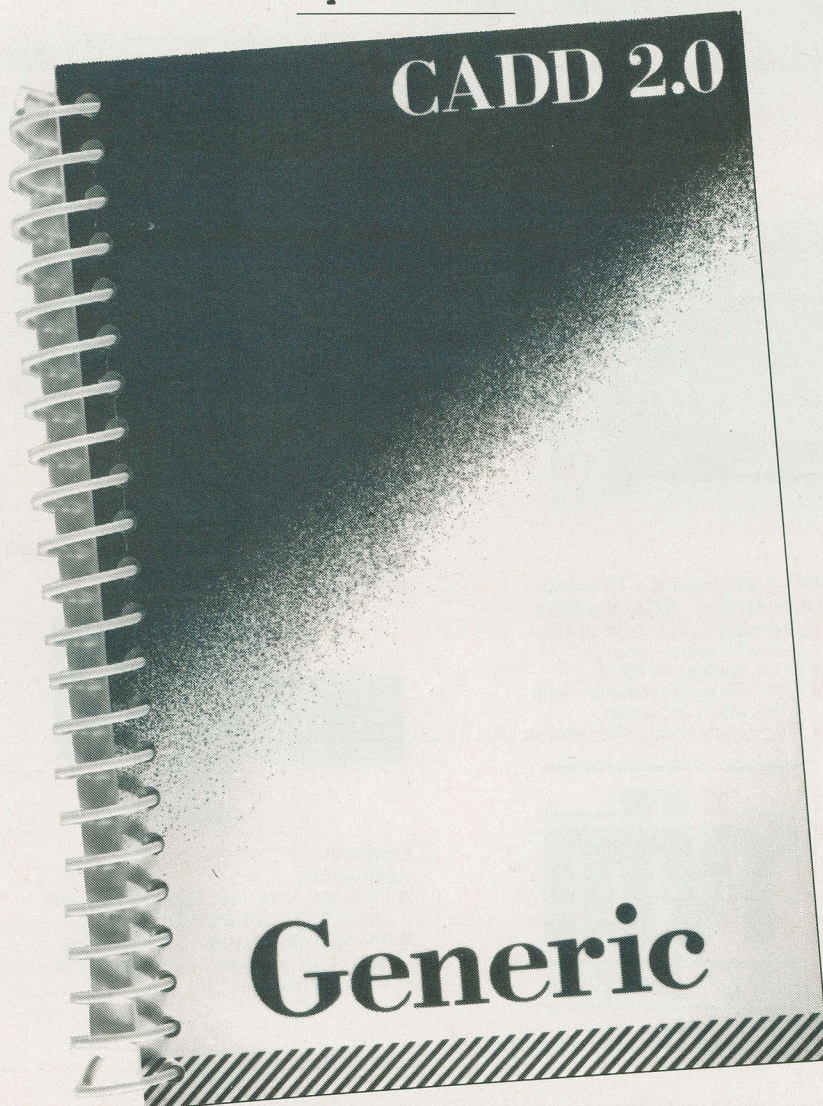
CN!



Software: **Pizazz**  
System: **IBM PC**  
Application: **Flexible printer driver**  
Manufacturer: **Application Techniques Inc., 10 Lomar Drive 2, Pepperell, Massachusetts 01463, (617) 433-5201**  
Price: **\$49.95 (US)**

# The Generic CADD Review

by Frank Lenk



**G**eneric CADD... from Generic Software... is sort of like the Rocky Balboa of CAD packages. It tries very hard to come across like a big time program, and in the end fails only on a couple of technicalities. It's the sort of program that could win a lot of admirers purely by virtue of trying so hard. If its developers continue to enhance the software... now in version 2.0... you just know that Generic CADD could be "a real contender".

As it now sits, Generic CADD is certainly the clear winner in the AutoCAD lookalike sweepstakes. It definitely *looks* like a powerful system, with its AutoCAD menu down the right hand side of the screen, co-ordinate display at upper left and voluminous prompt messages appearing on the three bottom lines of the display.

There's a lot of elegance about the basic interface. If you're lazy or inexperienced, you can pick commands off the nested menus. Later on you can move into high gear by entering commands using mnemonic two keystroke combinations. For instance, *qu* means quit. *Re* means begin drawing a rectangle. Not all the commands are this obvious, of course. For instance, all the *layer* commands start with a Y... but then, this is little different from WordStar's use of *control K* for block commands. If this is still too much for you, Generic CADD allows you to assign your own favourite commands to the function keys.

This command driven orientation is not only convenient, it also permits Generic CADD to accept batch programs, using the same commands you'd use in interactive mode. The system will even save an entire drawing in batch mode, creating a command file description of the image. The batch files are in standard ASCII format, so you can easily hack them with a word processor, if you feel the urge.

Just as menu commands can be entered from the keyboard, cursor commands can be entered either by mouse or by keystroke. You can instantly move the cursor anywhere on the virtual page simply by typing in co-ordinates.

Generic CADD is geared to a pervasive type of dimensioning. The on screen co-ordinate display shows not in pixels... or something equally arbitrary... but in your choice of metric or British units. You can change measuring systems and even rescale the entire drawing at any time. You can also elect to work in absolute or delta co-ordinate systems. The former gives the usual abstract type of unit measurements, while the latter gives readings always relative to your last plotted position.

Like any respectable CAD program, CADD supports most of the common plotters. If you insist on using a dot matrix

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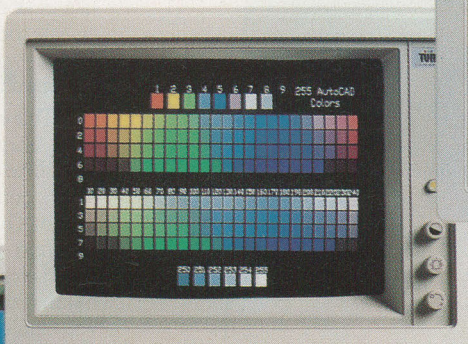


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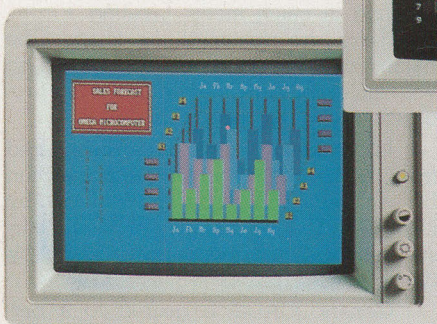
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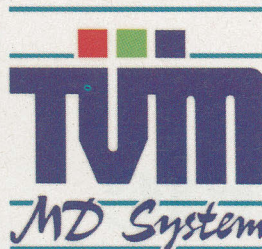
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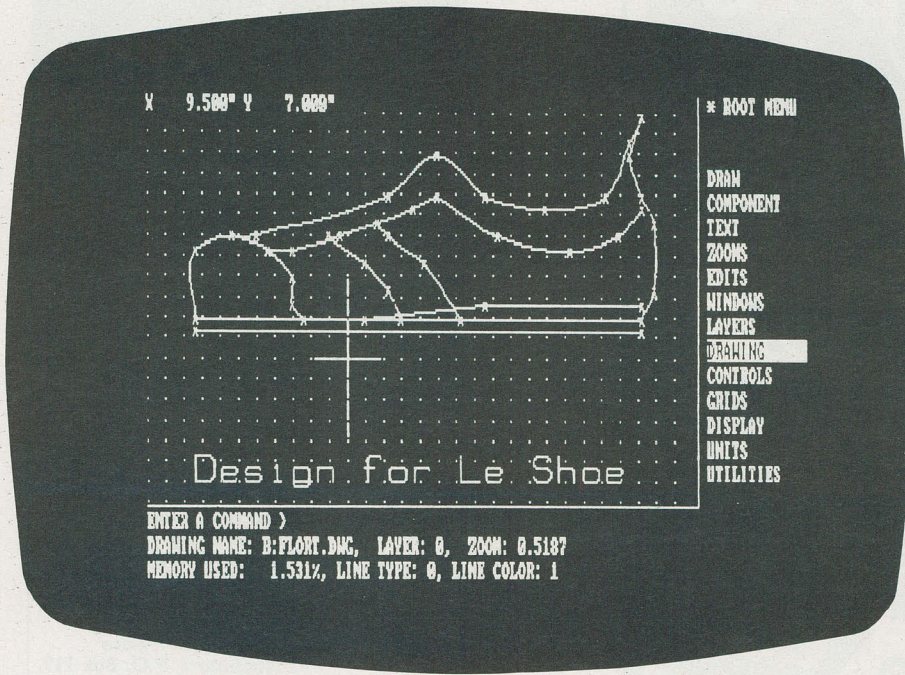
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## The Generic CADD Review



printer, however, you'll need the extra DotPlot package. DotPlot lets you dump any CADD file to your printer... at low, medium or very high resolution. You can scale your picture manually, or let DotPlot size it to almost fill your page. A preview mode lets you see what you're going to get. The printed results are quite handsome, but be prepared to spend a half hour over by the water cooler while your hard copy unreels.

You may take it for granted that Generic includes all the usual CAD drawing functions... and then some. Advanced features include the ability to define your own custom menus, or to design your own text fonts. All told, Generic probably gives very little away to the full scale CAD systems selling for ten times the price.

### Hard Line

Unfortunately, there is a down side. My troubles with Generic CADD began even before I loaded up the program proper.

There seems to be some sort of conviction among software developers that everyone in the world owns a colour monitor. This is the only explanation I can imagine for creating a configuration routine that works only in fancy colours... rather than assuming the simple, monochrome bottom line. If... like myself... you happen to be using a composite monochrome monitor, be prepared to drag out MODE.COM before reading any of the hardware configuration options in the Generic install program.

Even when you do get through the installation, don't assume that your troubles are over. I set the package up for my Mouse Systems compatible SummaMouse. This

mouse happily runs all software drivers written for the Mouse Systems unit... but, unfortunately, Generic CADD sees fit to get along without the standard drivers, accessing the mouse directly. The advantage of this unique approach is questionable at best... since CADD in fact refused to recognize any horizontal input from my mouse. I later tried the experiment with another computer... this one with a Z-Nix mouse, also Mouse Systems compatible. Mysteriously, CADD did acknowledge the Z-Nix mouse, although it evened the scales

by crashing completely after only a couple of minutes of operation.

Why the Z-Nix mouse worked better I can't say, unless it was because that mouse was on serial port one, while mine is hung on port two. However, the SummaMouse has so far worked perfectly with every other piece of software in creation, so I have no reason to blame the hardware.

With my mouse thus rudely cast aside, I had ample opportunity to experience Generic CADD's cursor key capabilities. This type of control, admittedly, is not terrible. However, using the CADD menus was a problem. Aside from being slow, the keyboard refused to access all the various items on the menu, since the cursor step defaults to something greater than the spacing between menu lines. I was therefore forced to learn about grid snap before I could do much else. The solution was to set snap on, which reduced the amount of cursor jump per cursor keystroke.

Learning to use CADD is mostly a matter of trial and error. There are no tutorials... printed or otherwise... no on line help, and no sample drawings.

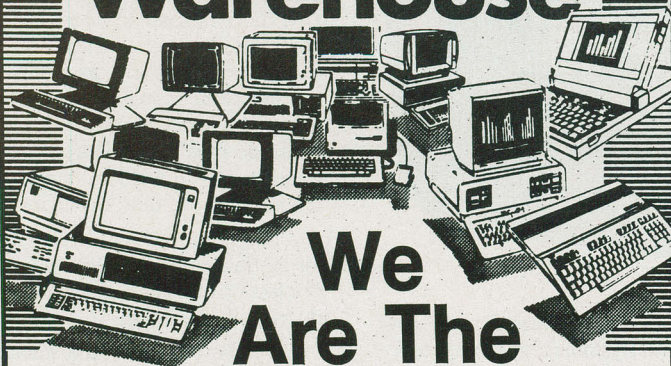
On the plus side, the menus are quite clear to anyone who has the barest CAD experience. The manual is also a lucid affair, in a convenient foldback coil binding. All the information is organized in reference fashion, conforming in sequence to the CADD menu system. Tutorial information... such as it is... is embedded in the various command entries. Amazingly, there are no diagrams to illustrate command operation. On the other hand, the index and table of contents are top notch.



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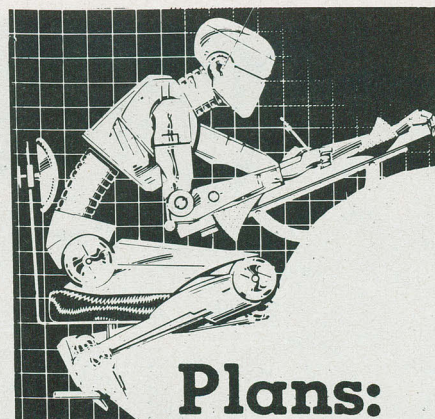
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## The Generic CADD Review



Software: **Generic CADD 2.0**  
System: **IBM PC (AT)**  
Application: **Computer aided design and drafting**  
Manufacturer: **Generic Software, 8763 148th Avenue NE, Redmond, Washington 98052, (206) 228-3601**  
Available From: **Saraguay Software Distributors, P.O. Box 117, Station P, Toronto, Ontario M5S 2S6, (416) 924-7218**  
Price: **\$159.95, plus \$40.00 each for DotPlot or AutoConvert, \$74.95 for Auto-Dimension**

As with most CAD systems, speed is a major hangup in Generic CADD. If you really can't get by on a pixel oriented drawing program, you should probably include the cost of a math co-processor chip in the price of your CAD software. Screen redraws in Generic took several minutes at a time... and that was for a more or less trivial test drawing. CADD does not allow you to interrupt a redraw, so be prepared to take a forced coffee break any time you hit the wrong zoom or pan option.

The accessory DotPlot module is even more speed limited. Nevertheless, I would consider DotPlot an excellent adjunct to the basic program... indispensable, in fact, unless you happen to own a plotter.

Overall, the reliability of Generic CADD does not seem to be as high as one might prefer. Aside from refusing to work with my mouse... and crashing during the brief trial of the Z-Nix mouse... Generic CADD crashed on at least one other occasion... apparently in response to an inadvertent jab at the *control break* keys. On yet another occasion, I got the disquieting message "Null pointer assignment" upon quitting the system.

Even so, Generic CADD is an excellent package for the moderate user who is willing to take a chance on its few quirks. If its reliability is cleaned up a bit, Generic CADD should take on a rather high standing among its peers.

**CNI**



**"Dad,  
you've got to  
help me."**

"Sandy, what's wrong? Are you hurt?"

"No, Dad, I'm fine."

"Where are you?"

"At Pat's. We all came over here to celebrate after the game."

"It's almost 12:30. Isn't it time you called it a night?"

"That's just it. Remember you always told me if I was out never to drive with anyone who's had too much to drink? And not to be afraid to call you if I had no other way of getting home? Well, tonight I'm taking you at your word."

"Stay right there. I'm coming to pick you up."

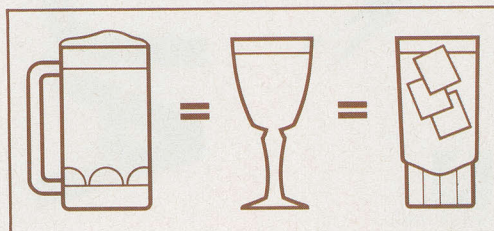
"Thanks, Dad. Oh, and something else."

"Shoot."

"Are you angry with me?"

"Angry? No, Sandy. Not on your life."

**Seagram**

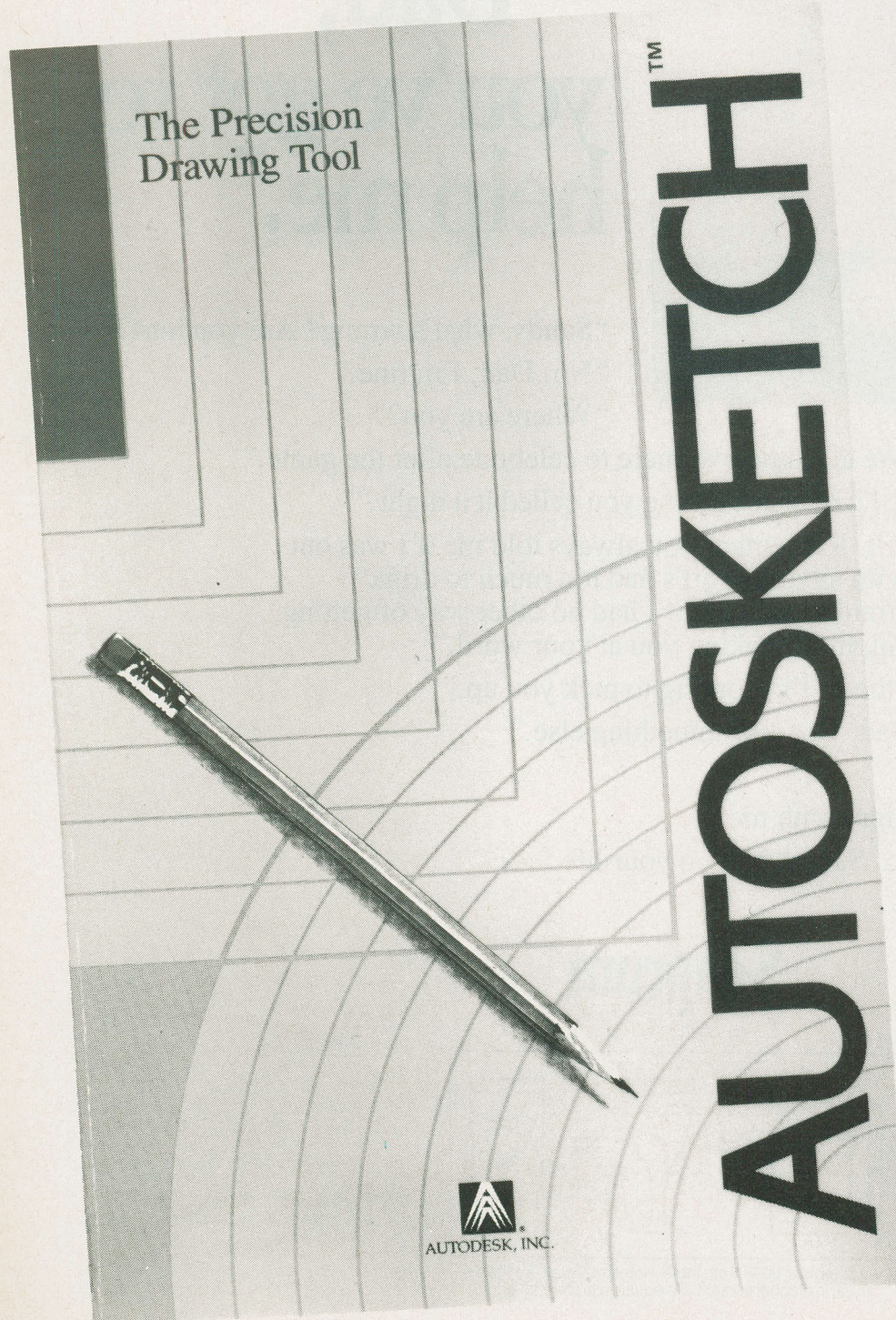


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# The AutoSketch Review

by Frank Lenk



**A**utoSketch... kid brother to the famed AutoCAD... is a truly paradoxical program. Although it comes from Autodesk, it doesn't really resemble its illustrious sibling at all. It purports to be easy to use but turns out to have some surprising traps built into it. Yet, overall, it gives the impression of an excellent tool for the serious but not too demanding user.

AutoSketch defies traditional categories. When you boot the thing up you'd swear that you've mixed up your disks and fired up GEM Draw instead. The screen takes on that typical black on white, Macintosh type of illumination. It acquires one of those inevitable menu bars across the top, and presents you with the well known arrow head mouse cursor.

None of this resembles a typical CAD package very much... and least of all AutoCAD, with its black screen, vertical menu and crosshair cursor. However, when you start poking around the menu selections, you discover that the system is indeed much more like AutoCAD than it is like MacPaint. Heavyweight functions such as dimensioning are represented in profusion, while fun stuff like pattern fill is nowhere to be found.

AutoSketch is genuinely intended to be a sort of child's primer of CAD. Autodesk specifically suggests using the program "to get your feet wet" in CAD "without drowning in a sea of commands and options." Although "extremely easy to learn and use", AutoSketch allegedly "sports features previously found only in systems costing one hundred thousand dollars or more." As if that's not enough, the front cover of the manual also bears the subtitle "The Precision Drawing Tool". Sounds too good to be true.

## Automatic

It's true that AutoSketch is an appealingly structured affair. You can figure out *most* of the operations without referring to the manual at all. If you do have recourse to the hard copy, you'll find it a handy guide... a thin paperback booklet, with an excellent index and table of contents. The quick reference card simply shows all the pulldown menu options, each with a brief annotation and keyboard equivalent... if any.

Installing AutoSketch is simple. It can

## The AutoSketch Review

be copied onto whatever medium you want it to live on, hard or floppy. The program fits on a single floppy disk, although there's unfortunately no room left over for accessories... like COMMAND.COM, which you'll need when departing the AutoSketch environment.

To boot AutoSketch, first install your mouse driver, then run SKETCH, a single file of almost three hundred and fifty kilobytes. The first time you fire it up, you'll automatically get a configuration dialog, asking you to specify your display device, pointing device and output device. Hercules, colour graphics and enhanced graphics displays are supported. You can get by with just the cursor keys, or use a Microsoft compatible mouse. AutoSketch claims to support an exciting variety of output hardware, ranging from plotters through dot matrix printers and right up to Postscript laser printers such as the Apple LaserWriter.

If you want to reconfigure the package later on, just delete the CFG file from your disk and this question and answer session will recur.

The interface is similar to that of the Macintosh. Use any mouse button to pull down a menu, then drag a highlighted selector bar down to the function of your choice. Many operations can also be invoked by function keys. Alas, the key choices are not subject to change, and are not all as obvious as one might prefer. For instance, F2 means redo... that is, undo... while alternate F2 means polygon mode. There is no short cut key for entering the text mode. Still, considering the easy menu access, any awkwardness with the keyboard seems relatively unimportant.

All the normal CAD drawing functions are available. You can draw points, lines, rectangles, circles, arcs, spline curves and polygons. You can erase, move, copy, stretch, scale, mirror and rotate screen objects.

As with all CAD systems, each drawing element... from the lowliest point to the fanciest polygon... is considered an object, or collection of vectors. As with most Macintosh influenced graphics systems, objects are selected by pulling a rubber band box over them with the mouse. However, AutoSketch adds a neat trick of its own. Pulling the box to the right from the first selected corner... the traditional direction to go... will affect only objects entirely surrounded within the selection box. Clicking the first box corner then stretching to the left grabs objects that are even partially enclosed by the box.

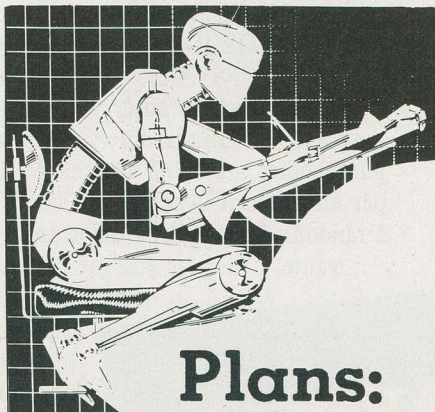
Then there are the drawing aids... a grid display, point snap, a co-ordinate display and so on. You can enter points simply by specifying their co-ordinates, rather than by mousing. A continuous co-

ordinate display can be accessed using a selection from the *measure* pulldown menu.

The *group* function lets you collect groups of screen objects together, so that editing operations can be performed on all of them at once.

Naturally, AutoSketch lets you zoom and pan around a large virtual page. The program even includes the elegant zoom box feature that lets you fill the screen with any specified portion of the picture.

The dimensioning powers of AutoSketch are some of its nicest features... a real treat to use. The *measure* menu lets you simply pick any two screen points, then specify the line to be used for displaying the standard two headed dimension arrow. AutoSketch instantly calculates the measurement, draws in the arrow and types the value in the appropriate position. Dimensions can be taken horizontally, vertically, or aligned to any arbitrary angle. This is the stuff that draftsmen's dreams are made of.



Software:	<b>AutoSketch</b>
System:	<b>IBM PC</b>
Application:	<b>Technical Drawing</b>
Manufacturer:	<b>AutoDesk, 2320 Marinship Way, Sausalito, California 94965, (415) 331-0356</b>
Distributed by:	<b>Parity Plus, 1611 Courtney Park Drive East, Mississauga, Ontario L5T 1V9, (416) 673-3321</b>
Price:	<b>\$150</b>

The *undo* and *redo* options utilize an established CAD trick, a command summary, stored in a special disk file. Using this file, the entire drawing process can be torn down or reconstructed, one move at a time. This gives the user virtually infinite undo control. The manual doesn't mention it, but I assume that in the event of a catastrophic power outage, this file could be used to reconstruct your drawing.

Text is handled quite well in AutoSketch. Although there's only one basic font, it can be scaled, italicized, underlined or overlined.

Strangely, AutoSketch does not directly support the AutoCAD file format. However, files can be saved to a DFX format using a separate option on the file

menu, so the connection is there if you need it.

There are some other odds and ends... some of them being *really* odd. For instance, if you lose mouse control for some reason, you can still save your drawing by typing *alternate "c r a s h"*. Also, tucked into the file menu is an option that pops up a little connect four game, perhaps the equivalent of the Macintosh's puzzle desk accessory.

So much for the good points. Now for some good old fashioned muck raking.

To begin with, although AutoSketch is purportedly aimed at the casual or inexperienced user, it positively demands hardware that such a user would be unlikely to possess... namely, an AT and a math coprocessor. Full scale CAD systems are notoriously lethargic about updating the screen display. Every time you zoom or pan, or load a new drawing, the entire image must be reconstructed from first principles. It takes a lot of calculating to figure out just where to put all the pixels.

Although it is a somewhat scaled down system, AutoSketch is not any faster than its more professional kinfolk. A drawing with only a few moderately frilly elements can take five or ten minutes to redraw. This makes the zoom and pan functions... and others... almost entirely useless, unless you have the hardware to support them. Even the little game runs much slower than public domain implementations of the same thing. Redraw operations cannot be interrupted... a real drag if you've accidentally gotten into one you don't really want.

Next, a word about printing. Unfortunately, that word is... literally... unprintable. Try as I might, I could not get AutoSketch to print at all. Not a single, solitary speck marred the blankness of my page.

The printing function *seems* to depend on the correct positioning of a cropping window. Although I specifically set up my copy of AutoSketch for Epson FX-80 output, the cropping window apparently came up incorrectly configured. I say apparently because even once I fixed the seeming discrepancy in dimensioning, AutoSketch still refused to print.

Now... there are enough tricks and twists to the printing process that I may have simply got some other setting wrong. However, for a program that claims ease of use as a selling point, AutoSketch simply failed to satisfy in this area.

Weighed against its other virtues, the slow speed and printing problems are not necessarily fatal shortcomings in themselves. Just make sure that whoever sells you your copy of AutoSketch is willing to get it up and running with your hardware. If you can overcome the printing problem... and swing a math coprocessor... AutoSketch should be a very useful tool.

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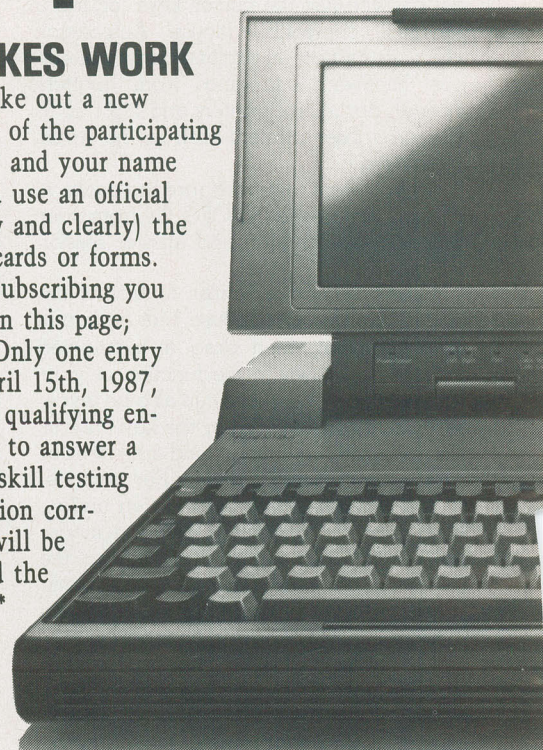
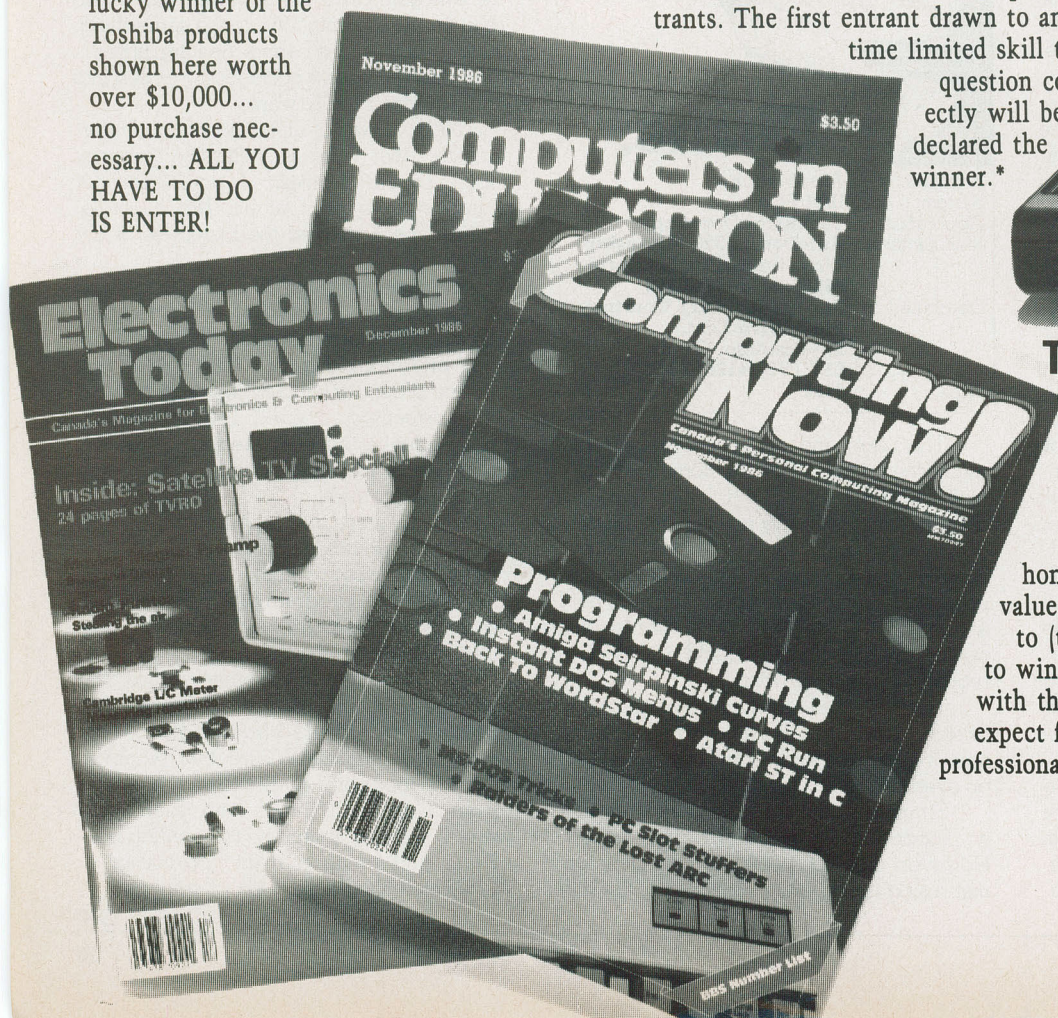
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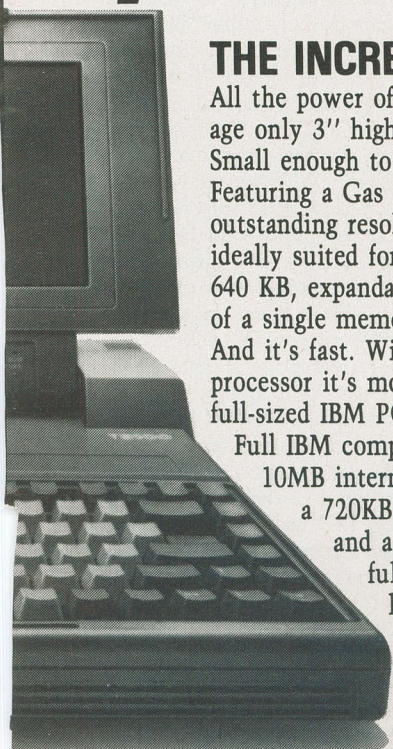
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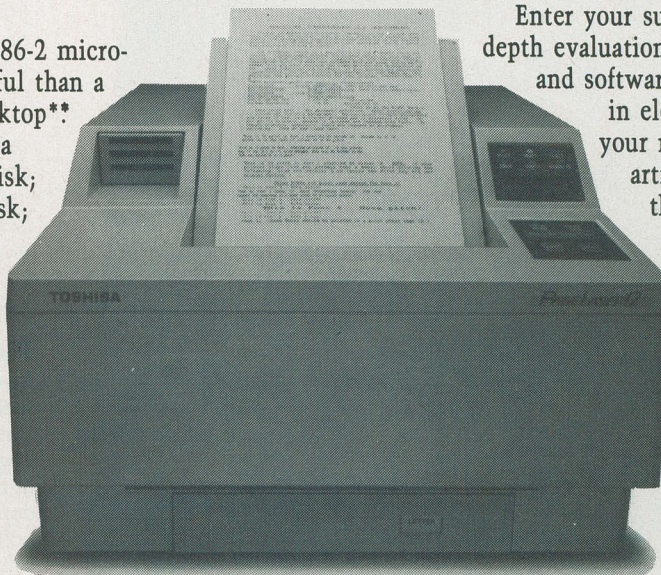
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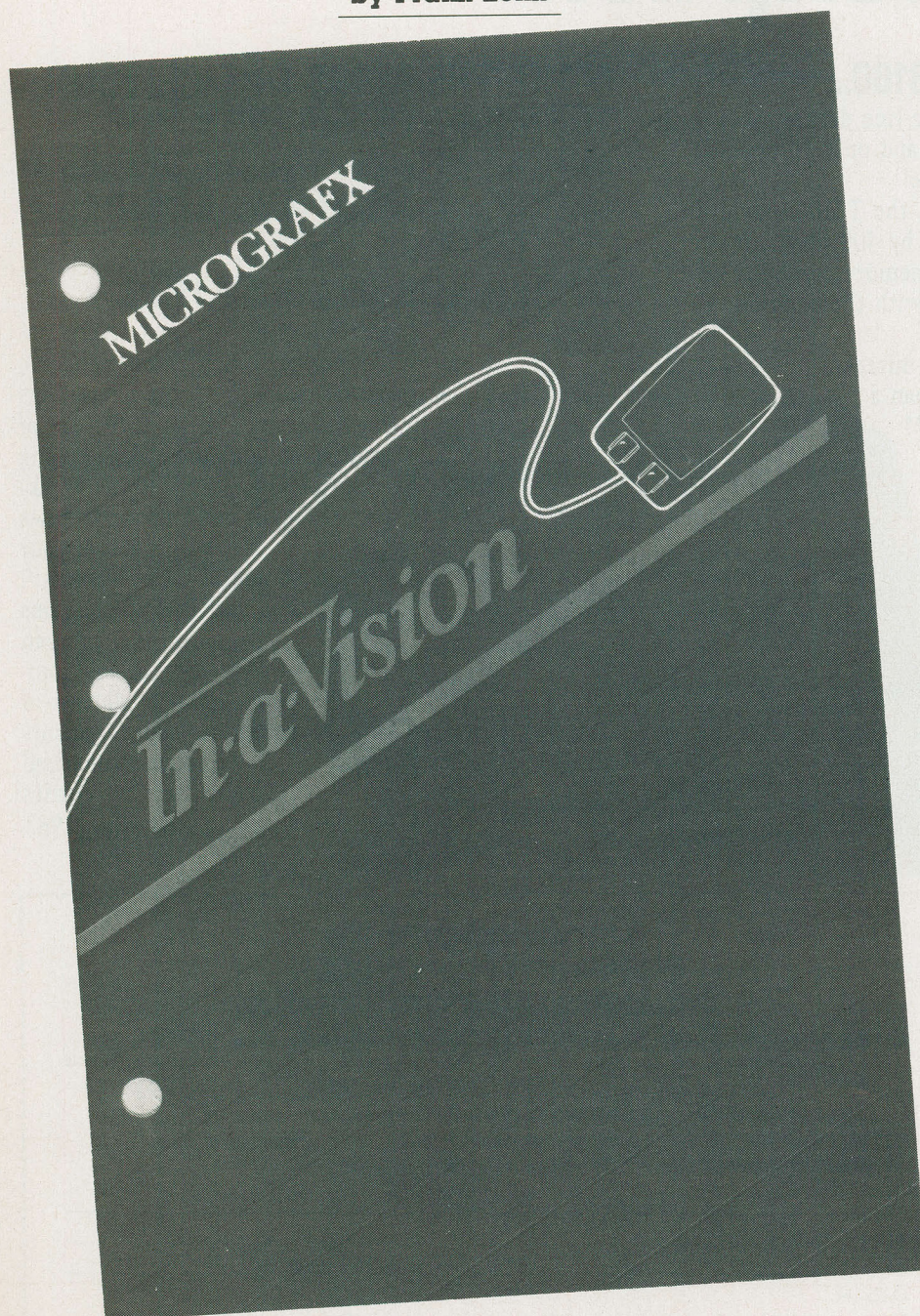
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# The In\*a\*Vision Review

by Frank Lenk



The asterisks in its name are not the only peculiar thing about In\*a\*Vision, from Micrografx. This is one of the most unusual CAD drafting systems around... but far from the least powerful.

In\*a\*Vision is unusual in being one of the few third party products available that supports the Microsoft Windows environment. This gives the program a rather unusual look... not quite like a Macintosh, but with most of the same advantages and some new ones of its own.

Of course, to get the full benefit of the Windows interface, you really need to run entirely under Windows. I still haven't met anybody who is doing that. However, if you did, you'd be able to display In\*a\*Vision in a window alongside any other Windows compatible software you could find. You would also be able to multitask In\*a\*Vision... a serious consideration, when you discover how long certain operations, such as printing, can take. However, even without Windows, In\*a\*Vision gets a lot of mileage from its sophisticated antecedents.

In\*a\*Vision has rather odd hardware appetites. Most CAD systems are ponderously slow, and in desperate need of jet propulsion devices such as math coprocessors or AT compatible micros. In\*a\*Vision, on the other hand, moves along at quite an acceptable clip... even on a floppy disk PC. On the other hand, while most of the less expensive CAD systems fit comfortably on a single floppy disk, In\*a\*Vision won't fit at all comfortably on three of them. This seems like a reasonably fair trade. I suppose you have no business considering CAD at all if you can't get together some decent hardware.

## Picture Window

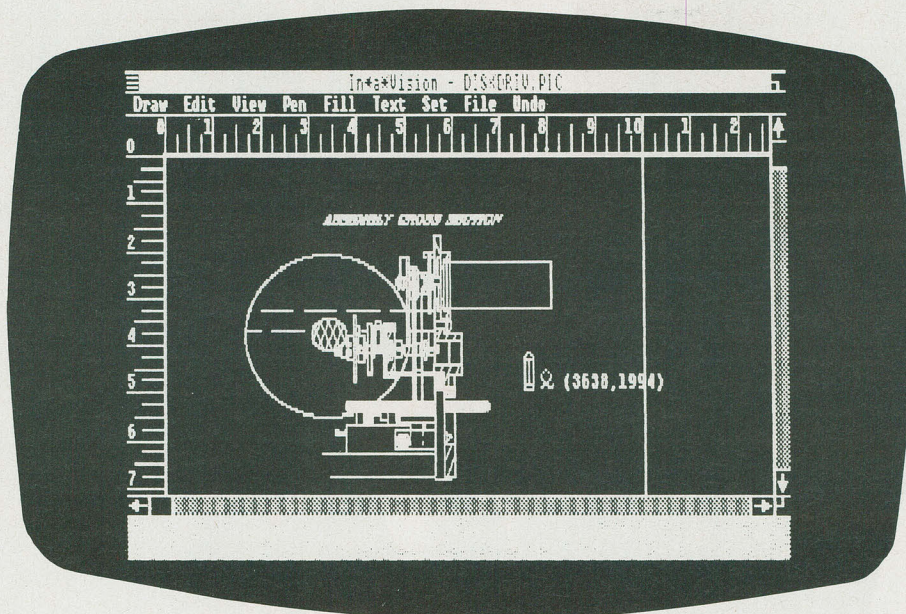
If you know Windows at all, you'll know that most of the interface is standard Macintosh stuff, with pull down menus and all that. There are a few novel icons... a little square at the top left pops up the special window control menu, and a wide grey bar at the bottom of the screen displays large icons representing any applications that are available but inactivated.

Scroll bars are a unique but attractive solution to the problem of panning around your virtual page. Just grab the little box with your mouse cursor and drag it over as far as you want the viewing window to travel. Or click on the scroll bar to move one screen width at a time.

A novel touch is that the second mouse button is left for the user to define. I know that it seems frivolous to admire a user interface for its own sake, but I found that the slickness of the In\*a\*Vision environment definitely made the program a pleasure to work with.

Although it looks like a high class pixel paintbox program, In\*a\*Vision actually

## The In\*a\*Vision Review



does contain a comprehensive repertoire of CAD functions. The *draw* menu lets you do arcs, circles, ellipses, elliptical arcs, pie slices, freehand lines, polygons, rectangles, rounded rectangles and squares.

Unlike most low end CAD programs, In\*a\*Vision features full pattern and colour fill, accessed from the *fill* menu. Unlike the usual Mac type programs, In\*a\*Vision also allows you to reset the screen colours, so you are free to work in white on black... or whatever motley combination you like. Beware printing from a dark screen, however, since the black will really come out black, rendering your printer ribbon a smoking ruin.

The *draw* menu includes the command to initiate text entry, although text attributes are set from a separate *text* menu. Text can be stretched to any size, bolded, underlined, struck out or italicized... or all of them at once, if you like. It can be printed in your choice of colours, if you have the hardware to handle them... preferably something like an EGA card.

The text editing functions include character delete, character insert, as well as the usual cursor pad movements. Each line of text ended with a carriage return is treated as a single drawing object, and can be edited as such using the appropriate commands. The selection of fonts included with In\*a\*Vision is quite good, and you can always add any fonts that are designed for use with Windows.

The *edit* menu includes the usual operations. First you grab some objects using the *block select* command. Then you can delete, copy, align, mirror or rotate them. You can change the way objects overlap, moving underlying ones to the top or vice versa. You can also combine multiple objects so that they behave as one for subsequent operations, or break up complex ob-

jects into their component parts. The *edit* menu also allows you to clear the entire drawing in one swoop.

Drawing aids such as grids and rulers are also accessed from the *view* menu. Layering is supported, with layers either enabled or disabled. Objects can be moved from layer to layer using a *block command* from the *edit* menu.

Co-ordinates can be displayed, and are measured on a grid that extends from an origin at the top left out by over thirty-two thousand units both horizontally and vertically. Oddly enough, the co-ordinate display follows your cursor all over the screen, rather than being fixed somewhere at the side. This keeps the numbers in sight, all right... except when you cursor over certain background textures which make the black numerals totally illegible.

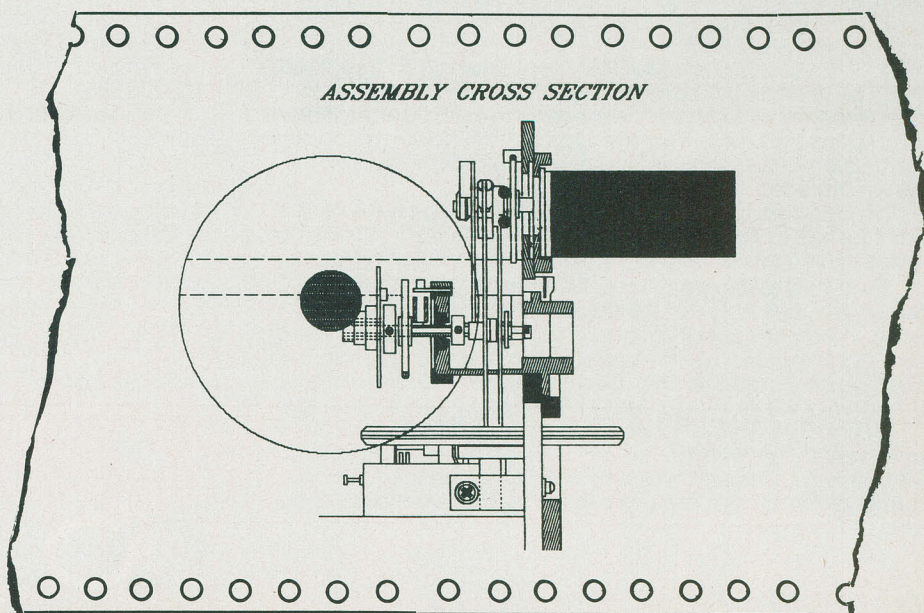
Screen units translate at the rate of four hundred and eighty per printed inch, giving a totally unprintable maximum resolution of two one thousandths of an inch.

For your printing convenience, the drawing area is automatically subdivided into pages, each equivalent to one printer page. Using the *view* menu you can display the drawing at actual size... the normal working mode... which shows things about the size that they will eventually print. You can also show the entire current page, or the complete work surface with page breaks displayed as a grid. You can also zoom in on smaller areas, although certain kinds of fonts show up only as greyed out blocks at magnifications other than actual size.

Parts libraries are implemented in In\*a\*Vision, but in a typically flexible manner. While editing you can open up a "template window" and display a library of predefined symbols. Templates can be edited much as normal In\*a\*Vision drawings, then cut and pasted into your working image. Template files are stored with the extension *tpl*, so the program can find them for you.

The speed of In\*a\*Vision is nothing short of incredible. Where most other CAD systems take minutes to redraw a screen, In\*a\*Vision takes seconds... even on a PC with no math coprocessor. I don't know how this is accomplished, although it may have to do with crafty use of template objects or similar graphic shortcuts.

In\*a\*Vision is speedy in another, still more wonderful way. It is the only CAD program I've seen that has really smart screen handling, in that whatever you want to do is given total priority over what the software wants to do. Thus you are free to cursor around even while a redraw is in progress. If you select a menu, the redraw





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## The In\*a\*Vision Review

pauses. If you choose a new option, the redraw is immediately aborted and things move on to your new choice.

The same thing is true of scrolling. For instance, if you pan sideways by an inch, the screen starts to redraw. If you scroll again before the redraw is complete, the screen immediately shifts and starts over. Just moving the cursor one sees the difference. A fast sweep of the mouse results in a broken movement on the screen, as In\*a\*Vision gives up on redrawing the pointer and simply moves it to where you want to go... about as fast as you can move your hand.

Printing is specifically relegated to a spooler program... apparently a stock Windows utility... that stores your graphic on disk before shuffling it out to the printer. Thus you can carry on drawing even while the printer chugs away.

The print quality, by the way, is excellent, even on a standard nine pin dot matrix. However, as you might expect, the output process is not exactly swift. It still takes up to a half hour to dump one page.

### As Seen In A Vision

The In\*a\*Vision manual is one of those bulky boxed binder affairs, but at least it is well written, clearly laid out and adequately... if not profusely... illustrated. Three major sections cover installation, a tutorial and reference. There is a decent index at the back.

Learning In\*a\*Vision is about as easy as with any of these Macintosh influenced applications. There are keyboard shortcuts

for many of the more useful commands, so the expert user needn't feel locked into the playpen.

The drawbacks with In\*a\*Vision are twofold... price and bulk. As described at the outset, this is a program that likes to live on a hard disk. If you want to climb into the Windows environment in a serious way, you can consider the hard disk mandatory. If you can live without Windows, In\*a\*Vision will work on floppies, but be prepared to juggle overlay files across three disks and save pictures to a fourth.

In\*a\*Vision is not exactly dirt cheap,

but it's still inexpensive enough to be highly appealing to small business users. One can easily see this program as a total replacement for things like GEM Draw... or MacDraw, for that matter... for applications such as business charts.

In\*a\*Vision definitely rates somewhere near the top of the heap as far as moderately lightweight personal CAD is concerned. Considering the program's nice combination of drafting, painting and text features, it should readily go beyond mere CAD and handle most any type of business or technical graphic tasks handsomely. **CNI!**

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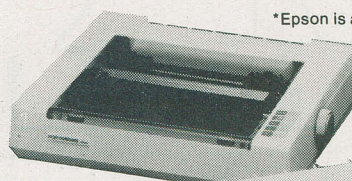


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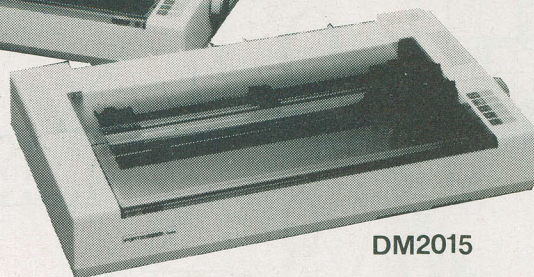
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System: IBM PC  
Application: Technical and business graphics  
Manufacturer: Micrografx Inc., 1820 North Greenville, Richardson, Texas 75081, (214) 234-1769  
Available from: Alton Computerware International, 71 Glen Cameron Road, Suite 6, Thornhill, Ontario L3T 1P5, (416) 731-7020  
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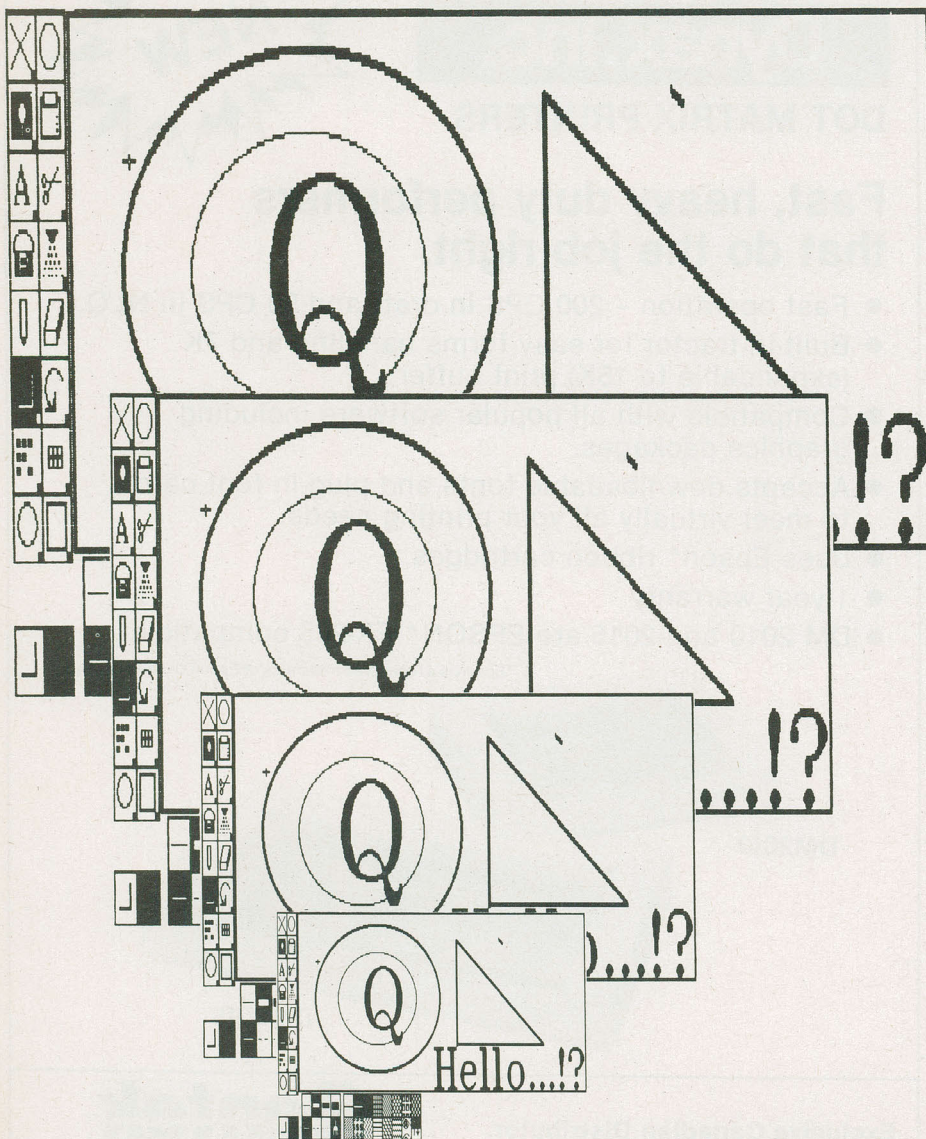
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# The Dr HALO Review

by Frank Lenk



**D**r HALO... from Media Cybernetics... stands out as being *the* classic paint program. The system is totally pixel oriented, features an utterly charming user interface and manages to come up with features one would expect to find only in CAD or desktop publishing systems costing several times more.

"Dr HALO" is really two separate programs... Dr HALO II, and HALO DPE "Desktop Publishing Editor". The two versions are virtually indistinguishable at first sight. Dr HALO is the lower cost, straight up personal paint system. HALO DPE adds a few goodies that make it an amazingly good alternative to the really massive desktop publishing products. After living with both, I'd say DPE is really the only way to go... but, judge for yourself.

## Halo Out There

Even before you run HALO... either version... you'll begin to be impressed. This software seems to support more different kinds of wild and wonderful hardware than you can shake a joystick at.

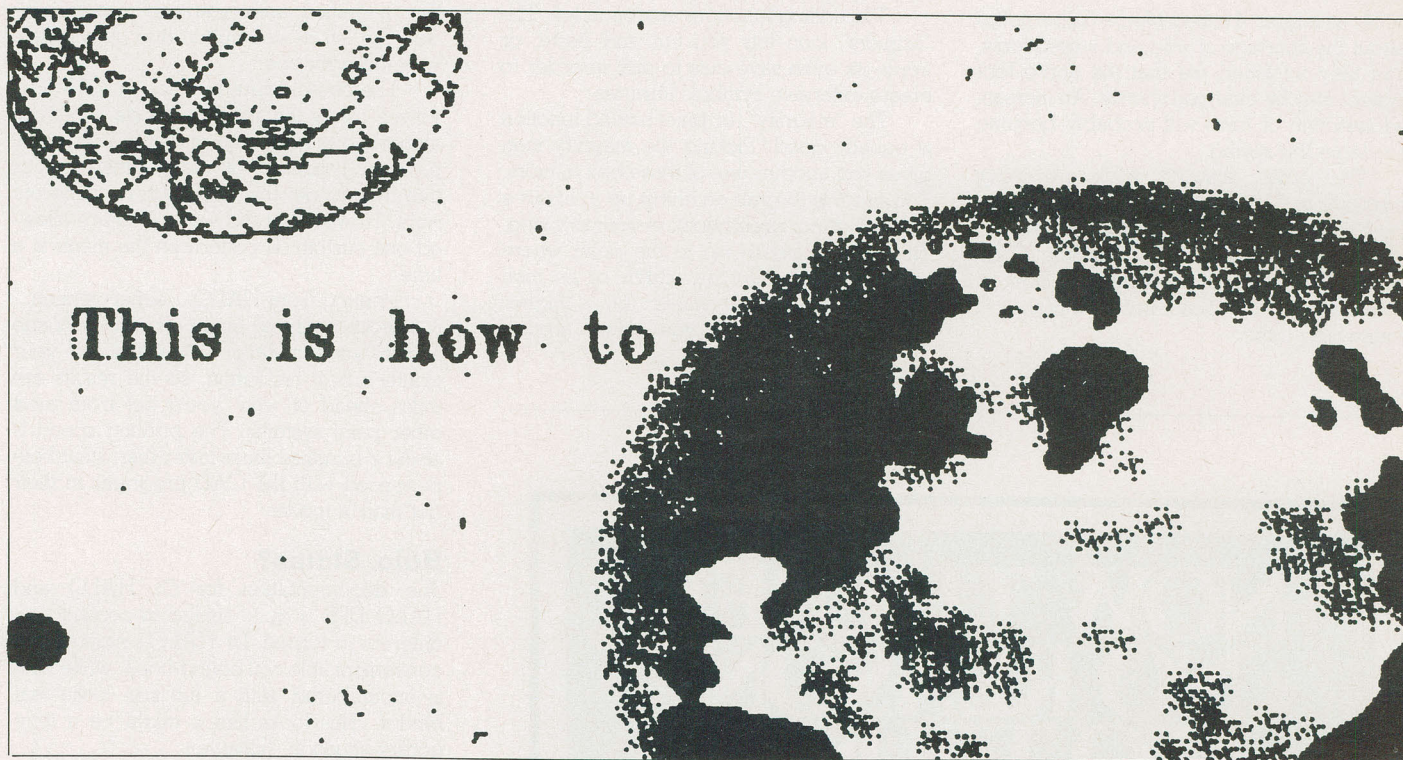
HALO DPE, for instance, has no trouble dealing with display cards ranging from the crummy old colour graphics adapter right up to such stratospheric technology as the million colour Number Nine Revolution or the ultra high resolution monochrome Wyse WY-700. A Hercules adapter... or one of the many clones popping up lately... would be my choice for best blast for the bucks. HALO makes a Herc board sing... in five part harmony.

The DPE version of HALO earns its desktop publishing credentials partly by supporting optical scanners such as the Canon IX-12.

You can choose from printers like the good old Epson, or hot new ones like the HP laser printers... with or without the Tall Tree ILaser interface... or even Apple's formidable LaserWriter. Colour printers are also no problem... for instance, try the IBM Colour Jetprinter, reviewed elsewhere in this issue.

All this device support is managed through a library of driver files, which are installed on your working disk by the HALO configuration program. A special screen driver handles virtual page operation... if you opt to install it... and allows you to work on a page much larger than your actual display screen. HALO DPE allows for *vast* virtual page sizes. The idea is that one screen pixel always maps onto exactly one printer dot... even if you're using a three hundred dot per inch laser printer. Mind you, you'll need a pile of extra RAM to hold all those pixels, hence the inclusion of Lotus Intel expanded memory support in the DPE installation.

The screen displays in Dr HALO and HALO DPE are almost identical. There's a boxed drawing area, and little square icon

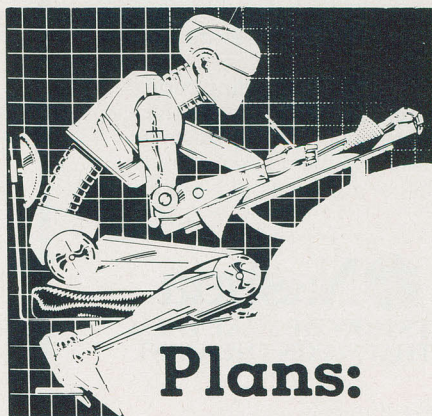


menus running down the left side and across the bottom of the screen. The menus can be flopped over to occupy the top and right screen edges, or hidden entirely to give access to a larger drawing surface. True to MacPaint standards, drawing tools appear vertically at the left, while line styles and paint patterns run across the bottom. A special box in the bottom left corner indicates your current drawing tool and pattern.

HALO DPE adds three extra icons. A large box just past the end of the pattern menu gives a constant display of cursor coordinates. Another box at the far right corner controls panning around the virtual page. Finally, a new icon is added on the tools menu to allow access to optical scanner features.

Using HALO is a breeze. The available tools include all the goodies we've come to know and envy from the Mac world. To begin with, there's freehand drawing. Then there are shapes... circles, ellipses and rectangles. Basic options such as "circle" appear on the tools menu and are activated using the left mouse button. More advanced variations, such as "ellipse", are invoked by using the right hand button, revealing a secondary selection of icons. Things like filled shapes would reside on one of these secondary menus. One of the neater tricks is the cube drawing function on the rectangle sub menu. Just draw two rectangles, and the program generates edges connecting them into a rectangular solid, and even fills the whole thing with your choice of color and pattern.

Box functions are handled with particular elegance in HALO. Selecting something like the rectangle tool changes your cursor into a little box. You continue to move around the screen as usual, plopping down rectangles by hitting the left mouse button. To resize the cursor box, just hold the right button and drag the mouse... the lower left corner of the box stays put and the opposite corner slides outward to whatever size you like. This kind of control is totally intuitive and unobtrusive... a pleasure to use.



### Plans:

Software:  
System:  
Application:  
Manufacturer:

**Dr HALO II, HALO DPE**  
**IBM PC**  
**Painting, publishing**  
**Media Cybernetics, 8484**  
**Georgia Avenue, Suite**  
**200, Silver Spring,**  
**Maryland 20910,**  
**(301) 495-3305**  
**Dr HALO II \$139.95 (US),**  
**HALO DPE \$195.00 (US)**

Price:

Furthermore, the same elegance extends to other drawing tools. For instance, the eraser works the same way... growing instantly to any size or shape you need.

Even better, text does the same thing. When you activate the text icon and select a font, you have a choice... you can pick a fixed point size for the text, or use the default of "infinity". The text cursor is, yes, a little box. You can stretch this box exactly the same way as the eraser or rectangle drawing box. Your text will stretch the same way. What's more, the text is generated from some sort of vector representation so that no matter what size or proportions you use the letters will be at their optimum resolution. No more jaggy text.

There's one small quirk to the way text entry works. You don't actually see your letters dropping into place on the drawing. Instead, the text appears in a special box at the top of the screen, displayed in a simple, standard font. Your cursor box grows off to the right, reflecting the size of your line of text. The drawback is that you can't see exactly where individual letters will fall when you finalize the operation by hitting *return* or the mouse button. The... serious... advantage is that the entire line can be sized before it is finally entered, by stretching the box just as before. If you ever need to align text precisely to some graphic feature, you'll find this feature absolutely miraculous.

Text can be enhanced with special features such as underlining or even drop shadows... in three levels of depth. The selection of fonts included with both HALO packages is limited... but complete enough,

## The Dr HALO Review

as far as it goes. I asked Media Cybernetics about the shortage of wild and varied fonts, and they informed me that the entire font system may be changed shortly. An increased selection of fonts will probably become available this spring.

The other drawing tools are fairly predictable. There's fill, airbrush, line drawing and grids. Line drawing allows you to do "spline" curves... a serious CAD feature... where you specify a bunch of points and HALO generates a smooth line connecting them.

The editing functions are top notch. The "scissors" icon lets you cut and paste, or copy, or even save cuts to disk in order to create extensive symbols libraries.

The "magnify", or pixel editing function is equally good. Picking the magnify icon gives you another one of those box cursors. You use this to grab anything up to about a postage stamp sized chunk of your drawing. This area is blown up to the point where each pixel is about an eighth of an inch square... or a little smaller on a higher resolution display. As you cursor around

the magnified area you can insert pixels with the left mouse button and delete them with the right one.

The one obscure function in HALO involves using the magnify mode... heaven alone knows why... to generate custom fill patterns. It never took me less than four or five tries to get this operation to come out right. However, it did work. You are allowed one custom fill pattern on the menu at a time.

Printing from HALO... either version... is a most gratifying event. The virtual page allows you to take advantage of your printer's best resolution, so the results are miles ahead of what you'd get from most other paint systems. The printing speed is about a hundred times faster than what I experienced with the CAD programs in their dot matrix modes.

### Halo, Statue?

The documentation for Dr HALO and HALO DPE is quite similar in content, but different in format. Dr HALO's manual is a convenient little coil bound book, while DPE is encumbered with a full size loose leaf binder. This looks like it might be a temporary situation, however.

My only question with HALO was not whether it was the best paint system I'd seen, but which of its two versions would be the one to get. Eventually, it seemed to me that there was little reason to choose Dr HALO, in spite of its lower price.

DPE is better at handling its virtual page, allowing more of the drawing tools to be used in both full page and local modes. For instance, Dr HALO won't allow very large texts to be entered while in full page preview mode... although both systems will allow text files to be ingested. DPE also offers co-ordinate display, an absolutely indispensable feature as far as I'm concerned. Lining screen objects up without it is a real pain. On a PC the co-ordinate display makes cursor motion noticeably sluggish, but you can always switch the numeric stuff off by clicking on the co-ordinate box.

HALO DPE lacks certain key features that would be required to make it a true desktop publishing program. For instance, incoming text is not reformatted around graphics. There are in fact no text formatting features at all. On the other hand, HALO's vector text maintains lovely resolution no matter what size you puff it up to. The mix of features is about right for creating single page material... posters, signs, cards, that sort of thing. I'd also pick HALO DPE over most PC CAD packages, for simple work at least.

Whichever version you choose, HALO is a jimdandy bit of software, with all the graphics possibilities you could want, an unusually good user interface, *plus* the ability to create crisp text. You'll have a tough time prying this one out of your disk drive. **CNI**

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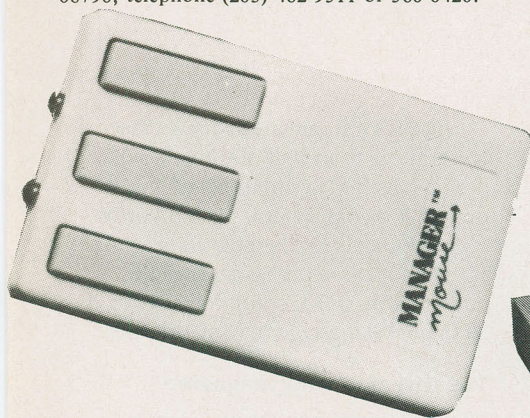
# COMPUTER PRESS

Continued from Page 7

## No Strings

Torrington's cordless mouse uses an infrared datalink to transmit information to a receiver which is Velcro mounted to a monitor, computer or other convenient surface. Like the rest of the Manager Mouse line, the cordless unit uses two small, maintenance-free wheels instead of a roller ball, and a patented suspension system which eliminates the need for a special tablet.

\$230 US buys you the mouse, receiver/charger with power pack, driver disk, manual and an adapter for the IBM AT; for more information and local dealers, contact The Torrington Company, Torrington, Connecticut 06790, telephone (203) 482-9511 or 560-0420.



## MacScanning

● Dest Corporation has a version of Publish Pac scanning software for the Mac Plus, designed to work with Dest's PC Scan and Scan Plus page scanners and allowing text, photographs or line art to be entered into desktop publishing, and image or word processing applications. Costing \$1,000 in Canada, and available for IBM PCs as well, it's distributed by Markham Technologies, 350 Bay Street, Suite 902, Toronto, Ontario M5H 2S6, telephone (416) 362-0362; in the Ottawa area call (613) 236-3038.

### Circle No. 27 on Reader Service Card

● Introduced at Comdex, Abaton's Scan 300SF model 1 is a 300 dpi personal scanner which allows users to manipulate photographs and line art images under the proprietary software C-Scan, all for a price of \$1895 US. Scan 300FB is the flat bed version, costing \$2295 US. Both are available from Abaton Technology, 7901 Stoneridge Drive, Suite 500, Pleasanton, California 94566, telephone (415) 463-8822.

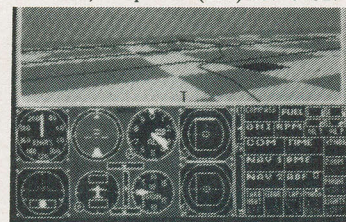
### Circle No. 28 on Reader Service Card



## Fancy Flying

SubLOGIC has just released their Flight Simulator II software for the Amiga and Atari ST computers, complete with 120 airports in five different scenery zones, multiple viewpoints, adjustable environmental factors, and three different aircraft modes... Cessna 182, Gates Learjet 25G and World War I Ace. Also featured is a multi-player option.

For direct order you pay \$49.95 US plus \$2.00 US shipping, to SubLOGIC Corporation, 713 Edgebrook Drive, Champaign, Illinois 61820, telephone (217) 359-8482.



## On The BIOS

A BIOS ROM for ATs and compatibles, with a special version for XT's, has been designed to interface a hardware manufacturer's design with industry standard MS-DOS. Made by Award Software, it's available from Canara Technologies, 5560 Kennedy Road, Mississauga, Ontario L4Z 2A9, telephone (416) 890-2525.

### Circle No. 29 on Reader Service Card

Continued on Page 70

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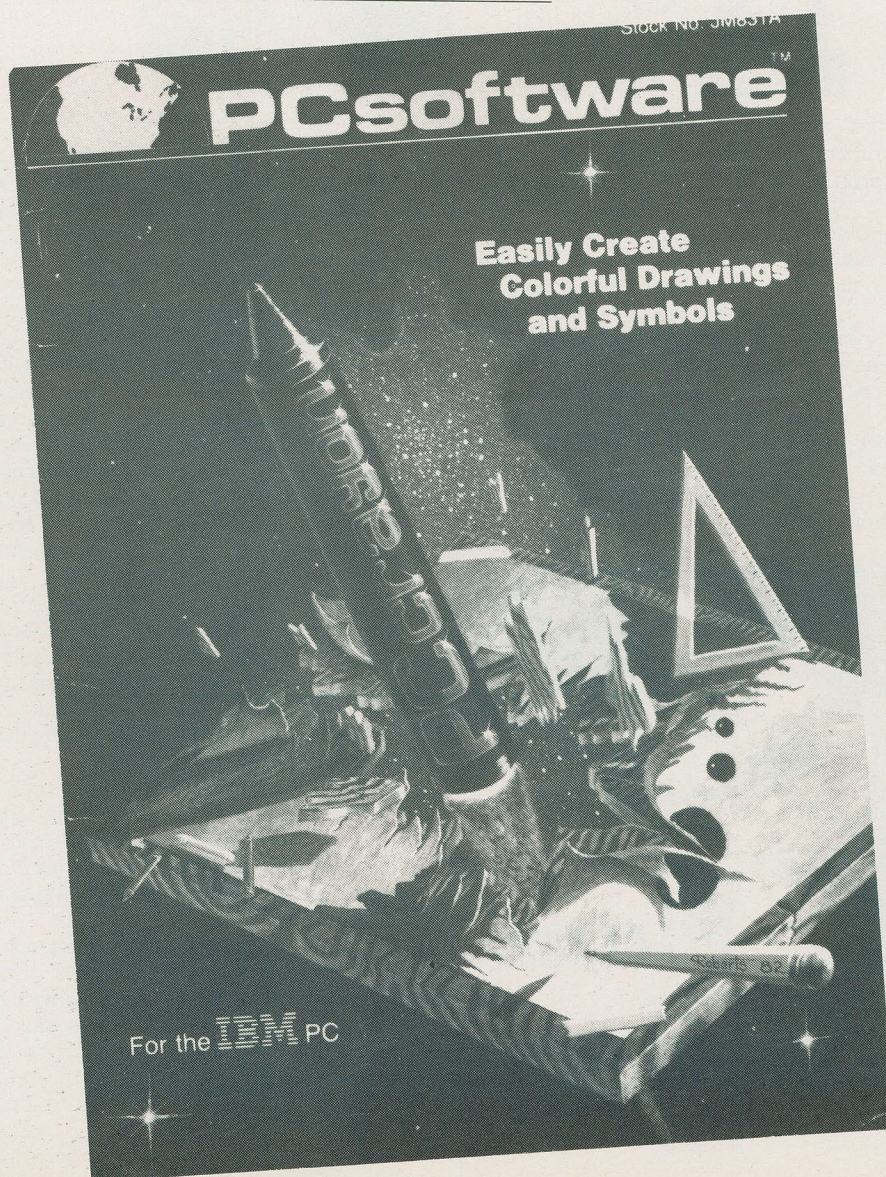
Roland 5280 (for AT)

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Circle No. 12 on Reader Service Card

# The PCcrayon Review

by Frank Lenk



**P**Ccrayon, from PCsoftware, is an odd sort of throwback... kind of like that lost, lonely dinosaur the Japanese keep digging up at the local nuclear testing site. Like that old dinosaur, PCcrayon still packs a fair wallop. However, one wonders if it can long withstand a concentrated assault from the modern arsenal... and, of course, if you look closely you can see the zipper in the back.

One's first clue to the rather archaic nature of this software is that the setup procedure asks you to provide a copy of BASICA or GWBASIC. Now, the fact that this software is written in BASIC is not necessarily a serious condemnation. After all, PC-Key-Draw was developed entirely in BASIC, and yet acquits itself bravely even against today's biggest guns. However, PC-Key-Draw... like most software still being written in BASIC... is supplied to the user in compiled form.

Why PCcrayon is not compiled I really can't imagine. Some programs are supplied as a teaching experience as much as for their actual utility value. This does not seem to be the case with PCcrayon. The packaging is quite slick, and the programming quite complete.

PCcrayon is not exactly for the extravagantly demanding user. The phrase "kid stuff" does come to mind, and not entirely because of the application's name. Still, some folks might find a few things to like about this package.

## No Sharp Objects

The PCcrayon manual claims that this program "puts a graphics artist inside your computer". This may sound like a tight fit, but to tell the truth, PCcrayon does come up with an impressive list of features... drawing, clip art libraries, vector symbols, animations and text with multiple fonts.

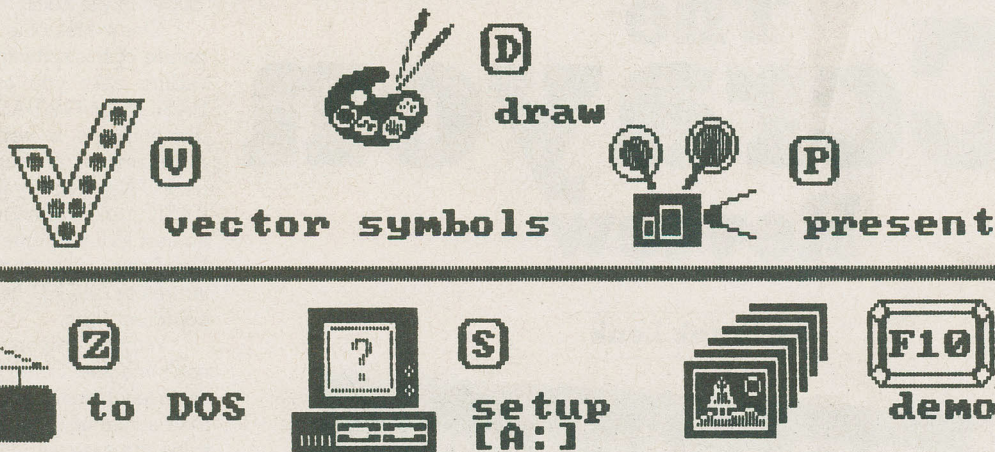
The catch is, none of it works all that well.

The manual begins to erode one's patience by hiding the configuration instructions at the back. The configuration process involves putting DOS and BASIC on your working copy of the PCcrayon disk. If you bought some kind of generic clone without BASIC... god knows it's high time that one should be able to own a computer without owning a copy of this abhorrent excuse for a programming language... you might as well forget all about PCcrayon.

If you do press on, the next unhappy surprise will be the degree of mouse support provided by the software... none. Well, actually there is a Mouse Systems driver file provided... in both compiled and source forms. However, this is the sort of thing you could whip up yourself in ten minutes. All the Mouse Systems driver does is pass keystrokes through the keyboard buffer, so the mouse can never be much more convenient than the keyboard. The mouse buttons

# PCCRAYON 3.0

(C) Copyright 1985 PCsoftware



are assigned commands that are not at all associated with freehand drawing, so you can't... for instance... simply draw a line by holding a button and dragging the mouse.

The cursor key support is not bad, however. The entire numeric pad works to provide eight direction control. The *ins* key toggles between cursor steps of one and ten pixels at a time.

The plus key turns on something confusingly called *worm* mode... that is, it starts drawing, or puts the "pen down", in turtle talk. The minus key raises the pen. You may look in vain for these obvious functions on the default mouse buttons. For some reason the mouse wouldn't do diagonals. I suspect the hysteresis value was set too high in the driver.

The cursor movement is acceptable, as long as you don't put the pen down. As soon as you do, cursor movement begins to suggest not merely a turtle, but more of a snail. Even with the cursor step set high, drawing a line across the screen takes forever.

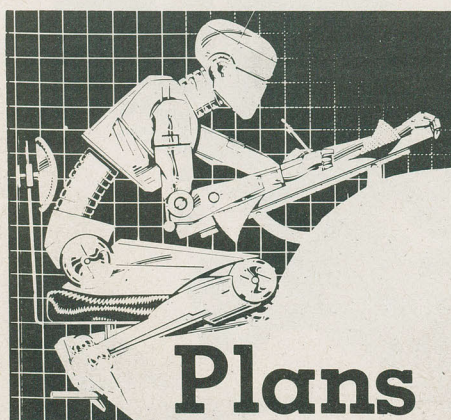
The simpler drawing functions are accessed via mnemonic keyboard commands. The O key starts a circle. A prompt at the top of the screen tells you to enter the center of the circle. Here, at last, is a function that can be handled from the mouse... a carriage return. As you cursor away from the center, you get not a rubber banded circle but simply a dotted line representing the radius. The circle itself draws rapidly enough when you hit return again... after all, this is a primitive command provided by Microsoft. However, circles won't draw in a position that puts them partly off the screen.

The B key starts a box... a rectangle, in other words. In this case you do get a full

rubber band representation. You can even drop multiple copies of the same box.

The line width can be set to any value from one to ninety-nine pixels, using the W command. Freehand lines and circles draw in the selected width, but rectangles don't.

Some of the other commands are surprisingly powerful. The A for "arc" command draws a curve through three points. You can use L to draw lines. The M and C commands give very traditional "move" and "copy" functions, both of which use a rubber band box to select areas of the screen. The G key allows you to "get" a picture from your library of clip art files.



Software: **PCcrayon**  
System: **IBM PC**  
Application: **Drawing**  
Manufacturer: **PCsoftware, 11627 Calamar Court, San Diego, California 92124. (619) 571-0981**  
Price: **\$59.95 US**

In PCcrayon, P is for "paint"... which means pattern fill. The selection of patterns is great... but all twenty look the same in low res monochrome. At high res, they look much better, but I couldn't select the low numbered ones for some reason.

The H key gives several screens of help. Unfortunately, it also resets your screen colours to something totally illegible.

There's a whole slew of commands reached through the Z key. These let you begin and end macro recordings, which can be replayed as animated displays. A demo program of this type is included with PCcrayon, and looks quite good. The Z commands also let you save and load pictures, and access vector symbol files.

Text is treated as a special case of these vector symbols. This means that characters can be scaled to their optimum resolution, no matter what size you print them. Of course, most of the fonts... there seem to be about a half dozen... are illegible at anything less than about a half inch high.

When selecting a vector file, you can hit a question mark and get a file menu. I tried using this convenience no less than three times, and each time I managed to get a different type of crash. Each time, I ended up back in BASIC.

I could go on, but there's little point.

PCcrayon is a good example of the kind of program that might have seemed like a good buy a half dozen years ago. Today, I might still consider buying it for the kiddies... but only if I could pick it up at bargain bin prices. You'd have to be a real cheapskate to deliberately pick PCcrayon over any of the excellent paint programs now available for the PC.

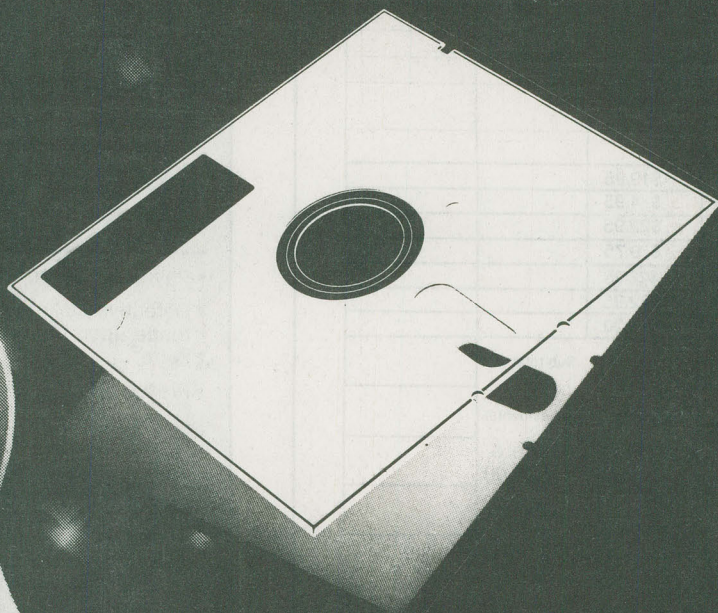
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Note: Unless otherwise stated, all software listed in this catalogue and distributed by Moorshead Publications has been obtained through public access bulletin boards and is believed to be in the public domain. A number of programs distributed on these disks are classed as "freeware" and contain requests for registration fees. Note that payment of such fees is entirely optional, but users who do register may be eligible for program enhancements and technical support.

All software distributed through this catalogue is offered free of charge. Prices listed for these disks serve only to defray the costs of the diskettes, postage and handling.

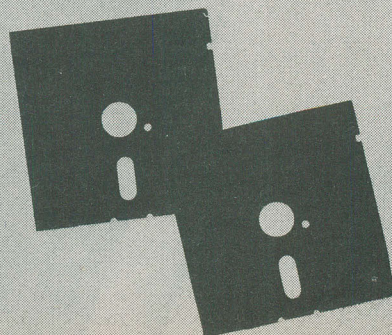
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**ARTIFICIAL ART** This is one of the most useless programs anyone's ever written, but you'll probably spend a lot of time running it. It generates an ever changing graphic image on your PC - with accompanying sound. While it may seem a bit pedestrian, it's a gas to watch. Requires a colour graphics adapter.

**AsEasy** This is a public domain spreadsheet package, very similar in its abilities to the more popular functions of Lotus 1-2-3. Unlike Lotus, it doesn't cost anything and it isn't copy protected.

**ASYNCR** This is an assembler file which creates a device driver to make the PC's serial ports behave as they should, with interrupt driven buffered inputs and outputs. This is a programmer's delight. Requires MASM to use.

**ChessII** This is one of the best chess programs yet devised for the PC. Aside from being small and fast, it lets you physically pick up the pieces and move them rather than entering board co-ordinates. Plays an evil game, too.

**HAUNT** This is a haunted house adventure game. You wander around looking for the mysterious pumpkin man while picking up things, encountering ghosts and, if you're not careful, getting busted for shoplifting. Very nicely executed, and it doesn't require any graphics facilities.



**LPTX** The most flexible printer redirection program imaginable, this thing lets you set up virtual printers, that is, disk files to capture the output of things that think they're printing. Includes both executable and source files.

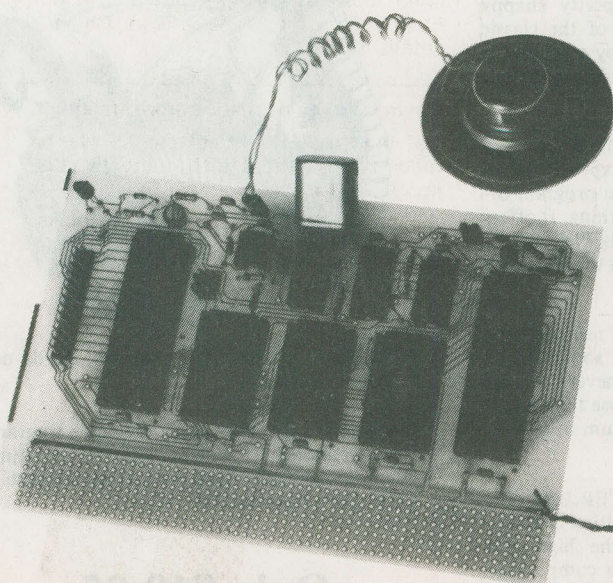
**PITFALL** This is a supremely clever ASCII game. Aside from being an absolutely superb game in itself, it's a clever use of the PC's screen. You get to pilot a spaceship down a winding, rather nasty pit. More fun than being beamed into a supernova.

**RAMDISK** Once you've installed a normal RAM disk, it's there for the duration. This one allows you to change the size of the disk on the fly, or blow it away all together, without having to reboot anything.

**ZAPDRAW** This is the C source code for the Graphics in C article from the January 1986 edition of Computing Now!. It creates a general purpose high speed PC graphics library, suitable for use on both the colour card and the Hercules board. Requires Lattice C or something similar.

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## The Learning Computer



Computers can do a lot more than play video games and run spreadsheets. Specialized dedicated microprocessor boards are at the hearts of the latest generation of television sets, appliances, cars and sophisticated industrial controls.

The design of these boards is a large undertaking and, as such, few programmers ever get a chance to learn the art of writing dedicated system firmware first hand. However, with the increasing use of microprocessors in all sorts of high technology, there is a growing need for people to write "ROMmable" code.

The Sloth board is a small dedicated microprocessor board which has been designed to be a general purpose small control board of the sort found in industry. It's not a trainer... it can be made to do the sorts of tasks that similar custom boards are doing in the real world. However, carefully documented and thought out, the Sloth is the ideal board for learning about this powerful aspect of programming.

The Sloth is based on the popular Z-80 microprocessor. It's programmed with inexpensive... and reusable... 2716 EPROMs. It has two kilobytes of RAM, three counter timers and twenty-four lines of I/O. It also has a speaker driver, and the Sloth package comes with an auxiliary six digit LED display board.

The board can be populated with easy to find parts. It can be programmed to be anything from a frequency counter to a video tape recorder timer to whatever one's imagination runs to.

The Sloth package available from us includes a bare Sloth main board and a bare LED display board, a parts list and overlay, a large easy to read schematic and a series of article reprints which document the board in great detail. This includes a source listing for a sample program to illustrate how the various devices on the board are accessed.

In addition to the Sloth itself, you'll need a system to develop Z-80 or 8080 assembler code and subsequently to burn it into EPROMs. We recommend an Apple compatible system running CP/M with a Multiflex PROM burner or an IBM PC running Z80MU and a PC compatible EPROM programmer. Z80MU, a CP/M emulator for the PC, is available separately from our almost free software service for \$19.95.

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**BOTH** If you print out a lot of documents, manuscripts, program listings or other manifestations of hard copy, you'll have noticed that the backs of the pages usually look a bit bare. This program can slash your paper bill by allowing you to print long files on both sides of the sheets

**DIAGS** Written by the author of Z80MU, this collection of tools will be nirvana for the experienced PC programmer. It does things like generate an annotated list of all the interrupt vectors in your PC, let you meddle with the 6845 registers, test most of the ins and outs of your system and so on. It's a brilliant bit of work.

**GRCP** Graphic cut and paste is a memory resident tool that allows you to scoop things from a PC high resolution graphic screen and pop them into other applications. Shades of the Macintosh.

**LOCKERUP** This tiny microbe of code sleeps in your system until you have to leave your PC for a while. Then it enables you to irrevocably lock up your keyboard until you come back to restart it. It's perfect for offices where there are more fingers than hands to contain them.

**MEGAPEDE** Just when you thought that it was safe to play ASCII games again... This one is a sophisticated variation of the classic "snake" programs and it plays with the speed of a boa constrictor. Don't count on winning for a while.

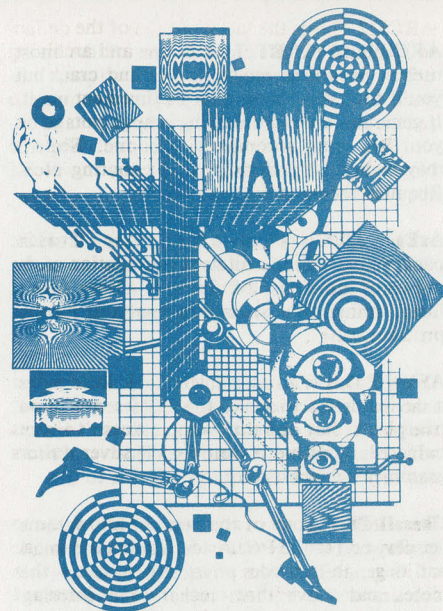
**MURPHY** Sort of an iconoclast in a can, this program will print a random selection of several hundred of murphy's laws, corollaries and commentaries thereon each time it's run. If you put it in your AUTOEXEC file it will say something clever each time you start your computer. Slaughters more sacred cows than McDonalds ever will.

**QUEBERT** This fast PC implementation of the classic arcade game is every bit as exciting as the real thing but lacks a coin slot. Jump down the mountain, avoid the snake and try not to get clobbered with fresh fruit. Sounds like real life...

**SAT** This is a powerful, menu driven satellite data downlink terminal, as discussed in the December 1986 edition of Computing Now!.

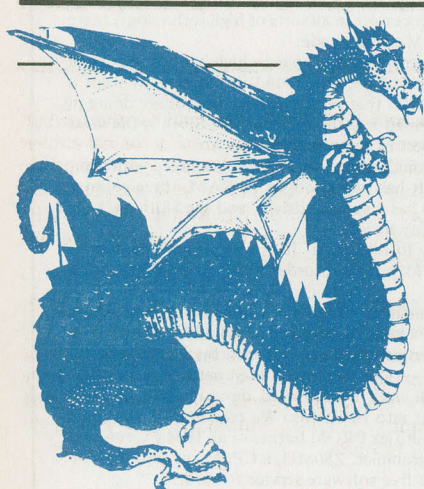
**SCAV** This is a great program for people who buy economical floppy disks and just about everyone else who can't afford a clean room for their PCs. It cruises through one's disks locking out bad sectors and restores previously 'fried' disks to usefulness. The ASM source code is included, as well as a COM file.

**SimCGA** If you own a Hercules card you'll have encountered the intense frustration of not being able to use programs written to employ the graphics of a standard colour card. This utility does an astoundingly good job of making the Herc card behave like a colour graphics adapter for quite a lot of software.



**STUFFIT** Stuffit is a disk management utility which stuffs files into the inner tracks of a floppy disk, allowing the outer tracks to be used for work space. This improves the disk access times and the reliability of mostly full disks considerably.

### Only \$19.95



**Bradford** Fancy printing programs, like Printrix and Fancy Font, are slick but expensive. This public domain version does much of what they do, but it does it for free. Requires an Epson or Gemini dot matrix printer.

**ZOARRE** This is another dungeon game, but terrifically well done and very intricate. It displays a picture of the room you're in, zaps you with various monsters and generally tries its very best to kill you. If you liked Castle you'll freak over this one.

**DIVERTFN** This is a tiny program which doubles the effective screen printing speed of most programs which print through DOS.

**DONKEY KONG** This is a pretty snappy public domain implementation of the classic arcade game. Getting squashed by oil drums is more fun than anything. Requires a colour card.

**MASTERKEY** The Norton utilities are extremely handy, but they're also expensive. This public domain disk manipulation program offers much the same power for nothing. It offers track and sector editing, unerasing files, and all the general low level fiddling that the expensive programs do.

**POPCALC** This is a clever bit of resident code that implements a moderately sophisticated calculator which pops up whenever you hit "ALT-C". It's fast, harder to lose than a real calculator and takes up a minimum of system overhead.

**PRINTER** This is the PRINTER.BAS program from the December 1986 edition of Computing Now!. It reprograms the high end characters of an Epson FX-80 (or compatible) printer to make them print IBM PC screen block graphics.



## Volume 18

**QUICKKEY** This little program speeds up the keyboard action.

**Card** This is the draw poker machine program from the December 1986 edition of Computing Now!. It's included here both as an executable COM file and as source code in C.

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## Volume 17

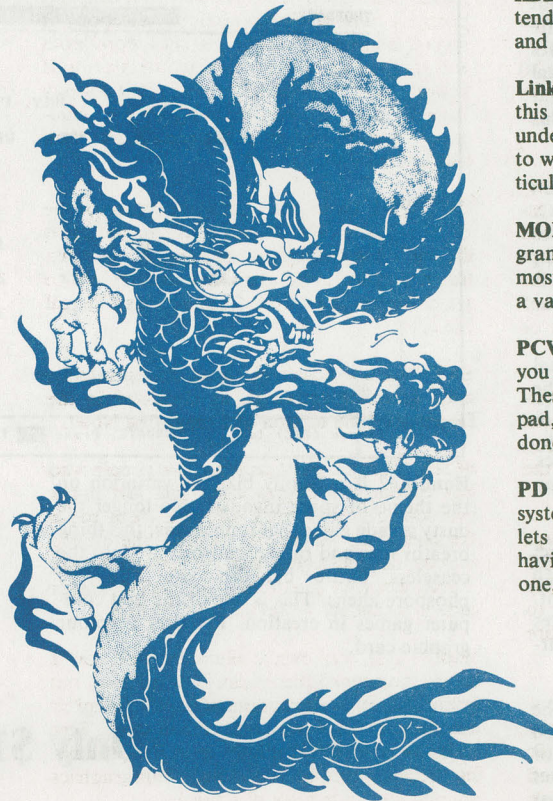
**ARC512** This is the latest version of the de facto standard PC file compression and archiving utility. It will create, maintain and crack unpack ARC files, providing a convenient way to reduce the size of files and to merge pots of little files into a single larger one. See the November 1986 edition of Computing Now! for more about this.

**ATC** ATC stands for "Air Traffic Controller". In this colourful simulation of the rigors of managing the planes at a busy airport may, among other things, renew your interest in train travel.

**Draw Poker** This is a really slick little poker machine simulation. The graphics are good, the play is fast and the machine doesn't always win. It's a shame it won't spew silver dollars out of your disk drives.

**HercBIOS** This set of routines will allow you to display text on a Hercules card when it's in one of its graphics modes - just as you can with a colour card. It will intercept the 10H interrupt vector so that anything that normally tries to print to the colour card will also work for the Hercules card.

**HotDos** If you've ever found yourself wanting to run a second program without quitting your first application, then HotDos was made for you! Hit its control key combination from within most popular programs and it will give you a DOS prompt to run any other program at. When you're done, type EXIT and you'll be back in your first application.



**KBD** This is a very tiny keyboard buffer extender. It's a useful few bytes to have around, and extremely tiny.

**LinkFour** A simulation of "Connect Four", this is a deceptively simple game. It's easy to understand, but requires practice if you want to win. The graphics and sound effects are particularly good.

**MONEY** Yet another Canadian mortgage program, this easy-to-use program is surprisingly most colourful. It will also calculate charts for a variety of financial situations.

**PCWindow** This is a resident utility which lets you call up a number of useful "windows". These include an elaborate event timer, a note pad, an ASCII code chart and so on. It's well done, fast, and fairly small.

**PD** This program redirects the output of one's system from the printer port to a disk file. It lets you to use things that normally insist on having a printer on line even if you don't own one, or don't want hard copy.

**Only \$19.95**

## Volume 16

**ARCDIR** The archive file compression system is the most efficient way to store large files in a small space. However, it's weird and complicated. This simple ARC directory utility was featured in the November 1986 edition of Computing Now!. Aside from being useful, it includes both a COM file and the source code so you can see how it works. Requires a C compiler if you want to meddle with it.

**BRICKS** The "Little Brick Out" game is one of the classic programs for microcomputers. This splendid version will get you turned onto simple games all over again.

**DX** This is a small DX-7 voice librarian, as found in the Book of Computer Music. It includes both a COM file and the assembler source code.

**MOREROOM** If you have a hard drive system you may have noticed that it's extremely inefficient with small files. Here's a collection of tricks to get substantially more space on your disk.

**E88** While huge word processors like WordStar and PC-Write can be used as text editors, they're hardly very good at the task and they gobble a lot of disk space. If you're trying to manage a C compiler or an assembler on a pair of floppies you've probably encountered this. E88 is a tiny - but powerful - text editor.

**EXPERT** Commercial Expert Systems software is still in its technological infancy. If you're interested in learning about expert systems and how they relate to your computing needs, you should try this simple program.

**FULLDOS** A DOS enhancement program that makes the DOS user interface behave in a rather more friendly manner. It creates a command stack and lets you re-execute previous commands.

**K9** This is yet another resident keyboard enhancer - with a difference. Aside from expanding the keyboard buffer, installing a screen timeout and so on, it makes a number of the alternate keys 'hot', giving you dozens of unique functions.

**InstantMENU** This is the code for the Instant Menus article which appeared in the November 1986 Computing Now!. With it, you can create elaborate batch file menus with absolutely no tricky programming. The menus can be easily altered with a text editor or word processor. Source code is included.

**PALERT** We've all occasionally run out of disk space while inside an application and discover that we've been dumped back to DOS unexpectedly. This is a serious drag if you've left a few hours of work behind you trashed in memory. This program warns you of an impending full disk.

**Only \$19.95**

There is a lot of good stuff on this disk... but most important, there are two dynamite games herein. We could get into the graphics package, the CP/M emulator, the fractal program in C... however, it's the games that do it. Plan to lose at least a weekend over this one.

**Altamira** is one of the nicest public domain paint box programs available for the PC. Unlike most of the so called graphics packages available for the PC, this one isn't restricted to doing bar charts and graphs. It does first rate pictures. Requires a colour card.

**Fractal** is the source code for the fractal generator in C that we looked at in the August 86 edition of Computing Now!. It's useful even if you don't like fractals, as it illustrates the use of high resolution graphics in C. Requires a C compiler and a colour card.

**NEMON** is a really weird game. You get stuck in the catacombs of king Nemon with nothing more than your wits and a flashlight. You have to find some keys, some treasures and, hopefully, a way around a host of arcade game nasties.

**Thor** used to be the god of thunder. Now he appears to be the world's most sophisticated desk calendar program. He'll remind you of appointments, keep track of your agenda and do things that would usually require a host of low tech objects, like pencils and note pads.

THORDATE: MONDAY JULY 21, 1986						
JULY, 1986						
SUN	MON	TUE	WED	THU	FRI	SAT
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Press (ESC) to exit THORDATE: Press F1 for Menu

**Round 42** is a wholly bizarre variation on the theme of space invaders. No longer the dusty arcade game that it once was, this thing breathes new and rather ichorous life into the ceaseless battle between you and the phosphore aliens. This is one of the best computer games in creation. Requires a colour graphic card.

**V20** is a CP/M emulator for users of the NEC V20 chip. Replace your existing 8088 with a V20, score this little program and most CP/M software will run on your system as if someone had stolen half the bits out of your PC. Regular MS-DOS isn't affected. Requires a V20.

Only \$19.95

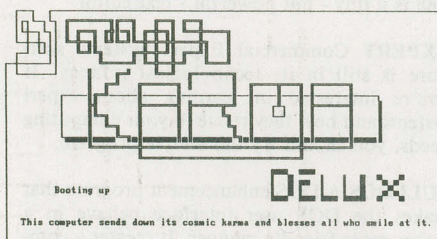
**Cut and Paste** is a memory resident program that allows you to grab text from the screen of any application and paste it into any other application that accepts characters for input. You could, for example, copy part of a Lotus spreadsheet and paste it into a WordStar document.

**INT13** will help you unravel the copy protection schemes of your software so you can make archive copies - just in case the cat takes a fancy to your masters. It prints a log of direct disk accesses and where they're called from so you can check out the code that's going after specific tracks, the heart of most protection systems. Includes the assembler source code.

**PMAP** tells you what's living in the memory of your system - and where. It will help you to find the resident utilities you have loaded and, more important, is great for sorting out peculiar interactions between multiple resident programs.

**SoftTouch** is a keyboard macro program not unlike ProKey. It allows you to store up to twenty five thousand key strokes, has a built in screen blanker and great wandering herds of other features.

**Sub Chase** is a first rate graphics arcade game. One sails across the clear blue sea - or green sea, depending on what sort of monitor you have - heaving depth charges off the stern to blow up subs. It's extremely well done and it has a panic button to clear the screen should the boss walk in. Requires a colour graphics card.



**TheDraw** is an ANSI screen editor. It allows you to create and edit full colour screens of text and graphics which can subsequently be typed to make them appear - in full colour - or integrated into programs. Requires DOS two or better, ANSI.SYS and is more fun with a colour monitor.

**Trek** is the best Star Trek game anyone has yet devised for the PC. The graphics are stunning, the complexity is intense and the action scoots along at warp nine as soon as the program gets going. Requires a colour card.

**Crossword** is a utility which translates text files from one application to another. It supports several popular word processors, including WordStar, WordStar 2000, Multimate, XYwrite, SideKick and standard ASCII. It saves ages worth of reformatting and does some useful things besides.

Only \$19.95

**CV** is a small utility for changing the volume name on disks. Since most of us never bother to specify volume names when formatting disks, this six hundred byte program provides a second chance.

**Breakout Box** is an assembly language program that hides in memory and shows you what your serial ports are doing. It's a valuable troubleshooting utility for pin pointing serial printer and modem problems.

**Icon Maker** allows you to generate sophisticated bit-mapped images. Its' easy to use and extremely colourful, producing data that can be incorporated into other programs.

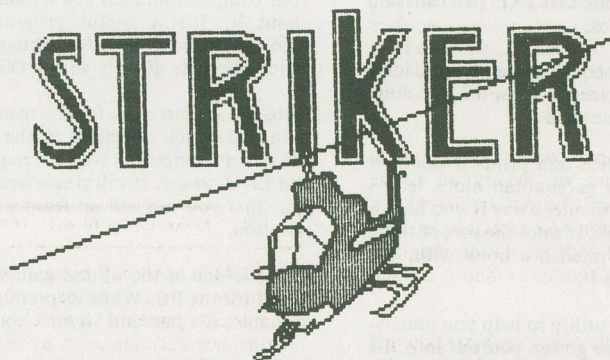
**Shell** is another DOS menu program. This one is very fast, free of 'snow', and provides easy access to virtually all DOS features.

**Striker** is an experience. It's a brilliantly written helicopter game in the style of Choplifter, complete with professional high resolution graphics and running spies. This is one of the best public domain games we've ever encountered.

**Ramset** is a RAM expansion program from the July 1986 edition of Computing Now!. It allows you exceed the PC's 640K memory limit. Ramset also lets you bypass the PC's time-consuming memory check.

**Trap** is the high-resolution Gemini patch program from the May edition of Computing Now!. It makes the Gemini 10x suitable for use with Personal Composer, but is easily modified

to fix most bit-mapped printing problems. MASM and Link are required to assemble the program.



**Almost Free PC Software Volume 12**

**Only \$19.95**

**Volume 11**

**Pac Girl** is, predictably, a variation on the almost mythical Pacman game. This one moves fast, and plays much like the arcade version.

**Menu** lets you create a menu-driven tree-structured environment that is friendlier and more manageable than is DOS. It's ideal creating interactive systems for non-technical users.

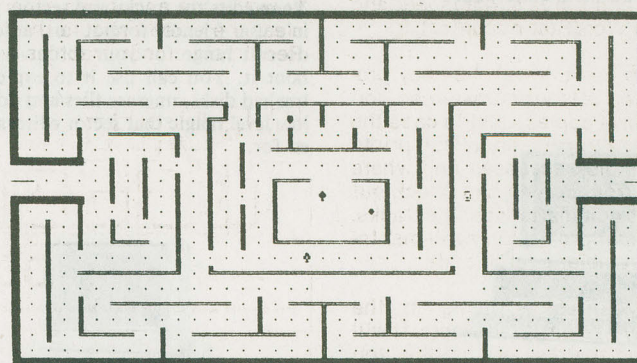
**Z80MU** is one of the most brilliant pieces of software we've ever encountered - free or not. It actually emulates a Z80-based computer running CP/M on the PC with no additional hardware - you don't even need a V20. It will run almost all CP/M software, including old favourites like WordStar and dBase. However, Z80MU also includes features lacking in both C/PM and MS-DOS operating systems.

**SERIO** is the assembler file from the July edition of Computing Now! that implements an interrupt-driven terminal in higher level languages such as C. It's also suitable for use with compiled BASIC. Both MASM and Link are required to use SERIO.

**Breakdown** is a peculiar program which takes meaningful text, analyzes it and generates

meaningless, but profound-sounding prose from it. If you've been wondering if your co-workers *really* read your office memos and reports, try filtering your prose through this program. The effects will be astounding.

**GRABIT** is the screen grab program from the July 1986 edition of Computing Now!. It will make a useable text file from the contents of ones screen at the touch of a key. MASM and Link are required.



**XMODEM** is a C language implementation of the XMODEM file transfer protocol, from the July 1986 edition of Computing Now!. It can be integrated into other programs to allow easy access to telecommunications facilities. This code requires SERIO (see above) and version three Lattice C.

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# Almost Free PC Software

## Volume 10

**Monopoly** is the first working implementation of the classic board game that we've come across - and we've had several that bombed pretty colourfully. This one is great, though, with fast and occasionally sarcastic play, a graphic board display and pretty good sound effects.

**D20** is the latest version of Steve's sorted directory program. This one uses DOS two calls and handles subdirectories.

**Edit** is a lightning fast full screen editor, ideal for editing program source files, dBASE stuff or other ASCII phenomena.

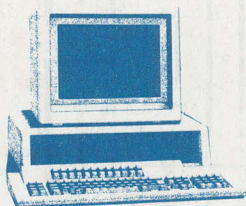
**Banner** takes mere text and prints it sideways on your printer - in gargantuan block letters that can be read from miles away if you have a good set of binoculars. It's not the sort of thing that you'd want to publish a book with, but sign makers will love it.

**Mortgage** is another utility to help you understand just what you've gotten yourself into. Its one of the nicest mortgage programs we've seen so far - lifelong debt and ruination has never been so well formatted.

**Quick** speeds up your PC quite a bit. It hooks into the video and makes it run a great deal faster, eliminating at least some of the glacial slowness that makes an IBM what it is.

**Speech** is a rather remarkable little germ of code. It talks through the PC's internal squeaker speaker. The voice isn't exactly human, but it's understandable on most machines. This is an interesting bit of work, one that can be accessed from within other programs to create talking applications.

**PC-AR** is an accounts receivable package for the PC. While not the equal of some of the commercial software that handles this function, it will take care of the records for a small or medium sized business quite well.



Only \$19.95

## Volume 9

**Small C** If you've ever wanted to try writing programs in the C language, this compiler will fascinate you. It's a restricted implementation of C, producing code which is compatible with Microsoft's MASM and LINK programs -you'll need these to get it going.

**Map** is an interesting little utility which will check how DOS is situated in the memory of your computer and tell you a number of things about it. It's a useful programming tool, especially helpful if you're debugging software which interacts directly with DOS.

**Note** is the source file for the memory resident note pad which appeared in the March 1986 edition of Computing Now! It requires MASM and LINK to use. It will create a resident memo page that you can call up from within any application.

**Pango** is one of the wildest games we've come across for the PC. While its premise is a bit improbable, it's fast and *weird* - hours of fun.

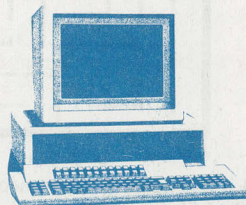
**PC-Spell** is a spelling checker written in BASIC. Despite its pedestrian sounding origins, it's fast, accurate and easy to use. It can be listed if you want to see how it works, and comes with a large dictionary file and a utility to assist you in customizing it.

**Peacock** is a memory resident program which allows you to change the colours of your screen with alternate function keys. It's useful, for example, if you run software which insists on using eye-straining screen colours.

**Recover** is a utility which assists you in getting data back from damaged files. It lets you look at your files one sector at a time in order to put the pieces back together.

**Tally** is a program which accurately counts the number of characters, words and lines in a file -all within your lifetime.

**Xeno** edits the tracks and sectors of your disks in a user friendly format - or, at least, one that doesn't lunge for your throat every time you boot it. You can use it to explore DOS, fix trashed disks, unerase files and do all the other low level magic that sector editors are renowned for.



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## Volume 8

**Load-Us** allows users of the popular Lotus 1-2-3 and Symphony programs to run them on a hard drive. This preboot program does not "crack" Lotus's copy protection scheme, but it does help legitimate users overcome the inconvenience of keeping a "key" disk in a floppy drive while running Lotus or Symphony on a hard drive.

**DDCal** is a very clever perpetual calendar and desk diary. It keeps track of your appointments and performs several other functions that you probably thought could only be done on the backs of match books.

**PC-Key Draw** is a remarkable public domain paintbox program which compares favorably with many commercial applications. It'll handle multiple screen images, business graphics and superb computer art - all in full colour. It's worth the cost of this disk all by itself.

**CPU** is a tiny program which tells you the effective speed of your system.

**Xray** is a remarkable co-resident utility which monitors what a program is doing while it's busy doing it. It allows you to interrupt the execution of your code and have a look inside.

**Game** - well, there are no words for this program, or, at least, none that are printable. This game is a bit rude - depending on just how weird your mind is, it can get pretty bizarre. This program does use some suggestive language, and we recommend that young or sensitive users not boot it.

**Tune** is a very small music generator which makes noises from within batch files. It's useful to see where things are in a complex process.

**Chasm**, or cheap assembler, is just the thing if you want to get into assembly language programming but don't want to spring for the Microsoft macro assembler package. It's reasonably fast, not too huge - it'll run in as little as sixty-four kilobytes - and, above all, it's cheap.

**Getdir** is a resident directory utility. It allows you to see what files are on your disks, even if you're in the middle of doing something else.

**CopyPC**, not to be confused with the commercial Copy II PC, is a quick disk backup utility.

**Lookit** is a full screen browsing program which lets you scroll forward and backwards through text files - sort of like a tiny word processor with no editing features.

**Syslock** is a security device for hard disk users. By running this utility on your XT or compatible, access to your computer will only be granted to users with a valid password.

Only \$22.95  
(two disk set)

## Volume 7

## Volume 6

## Volume 5

**BLACKJACK** is a BASIC implementation of this popular card game. It's both interesting to play and enlightening to dismantle. It can, of course, be easily listed so you can see how it works.

**EDSCR** is a screen editor which can be used with virtually any programming language from assembler to dBase III. The program lets you 'paint' PC screens with block graphics and saves them as .DAT files which can be easily adapted to work in most languages. An example screen is included.

**FK** allows you to make the function keys of your PC do more useful things under DOS. They can be redefined to execute commonly used commands and command sequences.

**FXMASTER** is a printer program for the popular Epson FX Series and compatible printers. It uses a full screen menu to enable you to easily change printer settings and modes.

**INDEX** allows you to generate indexes from WordStar documents... or text files from any other text editor. It's an invaluable writer's tool.

**KEYCLICK** is a memory co-resident program which will make your keys click. Small and easily included in an AUTOEXEC file, KEYCLICK solves many problems associated with clone keyboards.

**PCBW** is a small utility which makes colour screen displays show up in monochrome video. Great for users with colour graphics cards and monochrome monitors.

**PINBALL** is a pinball simulation that is easily worth the cost of this disk all by itself. The game plays much like a real pinball machine... but its hard to tilt.

**QUICKGRAF** is a powerful business graphics package which generates complex bar, line and scatter charts in medium and high resolution. An Epson with GrafTrax or compatible printer is necessary to produce hardcopy.

**SERPENT** is a variation on the classic snake game. Written in BASIC, this one is weird, but very fast.

**SHOWCLK** is yet another clock program... its the smallest one yet, and it beeps to chime the hour.

**VTREE** is a graphic TREE program that shows you how the subdirectories are set up on your disk... in a fashion more easily understood than the MS-DOS TREE utility.

**WORLD** is a remarkable program which incorporates a world map. It allows you to zoom in on specific areas of the globe, locate major cities and perform a number of useful calculation. It also has a feature for tracking hurricanes... tracked any good hurricanes lately?

**3-DEMON** is one of the most interesting variations on Pac-Man in the known universe. Instead of simply looking at a map of a maze, this program shows you a three dimensional view of it. You wander through endless corridors, munching food pellets or granola bars... your choice... and avoiding the deadly ghosts.

**DU** was one of the most powerful CP/M-based disk utilities ever created. This version for the PC captures much of its power and flexibility. It allows you to see what the tracks and sectors on your disks look like, recover erased or damaged files, and meddle with the system tracks.

**General Ledger** This is a complete general ledger accounting program. Written in BASIC, the program possesses most of the features found in commercial packages. An enormous documentation file is also included.

**PC-CHESS** is a slick chess program which makes good use of the PC's colour graphics abilities and boasts a running chess clock.

**RAMDISK** is the assembler source code for a memory disk program. If you've always wanted to know how these things work, or have a secret desire to write your own variation of this useful utility, here's your chance.

**VFILER** is a file management utility which lets you view files in a directory and allows you to COPY, TYPE and even run programs... in short, it does almost everything DOS does but it's user-friendly.

**QMODEM** is unquestionably the best telecommunications package in existence. The most recent version of it is replete with windowing, multiple protocols, definable function keys. And the code is unspeakably well debugged.

**ARC** is a sophisticated file archiving program which stores several files in single library files. As an added bonus, ARC applies one of four data compression techniques to each file in order to optimize disk space.

**ZAPLOAD** is a utility for programmers to handle Intel standard HEX files. Very fast and well documented.

**SOPWITH** Using superb graphics, SOPWITH lets you pilot a World War I biplane on dangerous bombing missions.

**JSB** Another BASIC music program for your collection. This one plays a soothing sonata.

ALSO: Star, Surface, Op.

**AREACODE** is a useful tool if you use the telephone a lot. Give it an area code and it will match it with the city in which the code is used.

**D** in another sorted directory program. This one emulates the CP/M style D, which is arguably more useful for most applications.

**FRACTALS** An amazing implementation of the Mandelbrot Microscope, which generates unearthly images on your screen.

**HIDE** is a set of utilities which let you create, enter and remove invisible DOS directories. This allows you to set up a hard drive system with secure areas which can only be used by people who know about them.

**LAR** is a library utility that allows you to concatenate several small files into a library to save on disk overhead. Individual files can be extracted as they are needed.

**MAIL1** is a mailing label utility written in BASIC.

**MORERAM** This is an assembler program. You need MASM and LINK to make it work. It lets you alter the memory setting on the PC's motherboard to enable it to use more than 640K RAM. It will even let you set the switch settings to 64K to speed up disk boots and then change the RAM setting after bootup.

**MORTGAGE** generates amortization charts.

**MXSET** lets you control the parameters of Epson printers from the DOS command line. It's a lot easier than LPRINTing characters from BASIC every time you want to change print modes.

**NUSQ** unsqueezes files that have been previously compressed to save space. Should be of primary interest to bulletin board users.

**PARCHK** is an assembler program which requires MASM and LINK to work. It installs a trap for parity errors in your computer. A vital aid to help locate suspect RAM chips.

**VDEL** is a Delete with Verify program. You could type VDEL \*.BAK and it would show them name of every .BAK file in the current directory and ask you if you want it deleted.

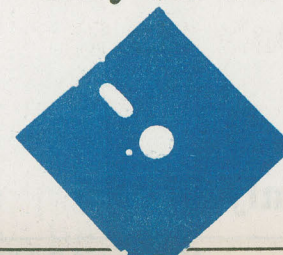
**WHEREIS** finds files in a complex hard disk system.

**ZAXXONPC** This is an incredible implementation of one of the most popular micro games ever created.

**Only \$19.95**

**Only \$24.95  
(two disk set)**

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# Almost Free PC Software

## Volume 4

**BUGS** is an off the wall ASCII game in which a player uses the cursor pad keys to move a 'nuclear fly swatter' around the screen blowing up a long crawling bug.

**CLOCK** is a useful tutorial in writing character oriented device drivers for the PC. In addition, the program is an improved replacement **CLOCK.SYS** file which works with many real time clocks. The **ASM** file is included.

**DEFRAG** is a utility that lets you "defragment" your disks to make your applications run faster. The utility reorganizes a disk, connecting up the fragments of files created by DOS.

**DOSEDIT** is one of the most useful DOS utilities available. It enhances the command line facility of MS-DOS by creating a command stack. Instead of merely being able to recall a command with the F3 key, **DOSEDIT** lets you use the cursor arrow keys to scroll through a whole stack of previously entered commands, re-executing the ones you need.

**DUMP** is a utility program designed to produce Hex dumps of object files. Useful in its own right, the program also serves as a good example of how to use DOS disk service calls. The **ASM** file is also included.

**FREE** is a tiny file which tells you how much space is left on a disk... without having to view an entire directory listing. Its especially handy for hard disk systems.

**LABEL** changes the labels on disk drive volumes. It's a simple utility, but useful if you use volume labels to keep track of your disks.

**LIST** is an improved version of the DOS **TYPE** command which shows you the contents of a file page by page.

**MEMBRAIN** is the most sophisticated RAM disk program we've seen yet. It lets users install variable sized disks and provides control over several other parameters.

**SPACE INVADERS** A fast variation of this popular arcade game. the graphics are superb.

**SPEED** is a simple program which changes some of the PC's floppy disk parameters and effectively speeds up disk accesses for some applications.

**WIZARDS** is an adventure game in the classic style, except that it ranks as one of the most sarcastic programs in creation. The program is vast... you can wander about its darkened corridors for hours.

ALSO: Backscroll, Bigcal, Crypto, Kbfix, Monoclok, Move, Newbell, Nuxq, Parchk, and Sp.

## Volume 3

**FIXWS** is a simple utility which modifies WordStar files so that they can be used by programs which work with ordinary ASCII files.

**WRT** DOS 2.0 allows for each file to have a 'read only' flag, but it lacks a way of manipulating them. This pair of utilities allows you to set and unset this flag, protecting important files from accidental erasure.

**BROWSE** is a timesaving program which provides a useful alternative to the DOS 'TYPE' command. **BROWSE** allows you to easily scroll up and down through text files, saving you the effort of running your word processor just to get a quick look at a text file.

**CAT** If the **DIR** display is too dull for your taste, **CAT** may be just what you need. It will tell you everything you could possibly want to know about the files on your disks.

**CGCLOCK** is a simple little program which displays the running time in the upper right hand corner of your screen. In addition, the program has lots of display options and works with the colour graphics card.

**CURSOR** A tiny twenty-four byte program which displays a large cursor on your monitor.

**CMP** This program does a very elaborate comparison of two files and reports their differences. It can for example, spot corrupted files and may prove useful when dealing with files created by redirection.

**JUMPJOE** A bit like "Miner 2049'er", this game is certain to damage your mind. You get to be the janitor of a space station and must deal with berserk robots and other weirdness. It's a hoot!

**CASTLE** Wander through a deserted castle collecting treasures... but mind you don't get killed by the nasties. A solution is included should frustration set in.

**78INT** This is a small BASIC program to calculate interest using the rule of seventy-eight.

**MOON** is one of the nicest lunar lander games we've come across. This version uses high resolution graphics and startling sound effects to hurl you to your doom in style.

**PERTCHT** is a BASIC program which prints PERT charts. It should interest anyone involved in project management and scheduling.

**DATNOIDS** is one of the strangest games ever put on a disk. In fact, mere words don't serve to describe it: you'll have to try it for yourself.

**NUK-NY** This is one of the nastiest bits of software we've ever seen. It produces a full color high resolution simulation of a nuclear attack on New York City.

## Volume 2

**SWEEP** is a disk utility which virtually replaces the DOS Copy command. It lets you **COPY**, **REN**, **TYPE** and **DEL** files quickly and easily from a simple menu.

**Worldmap** is a sophisticated graphics program which draws a very detailed map of the world. It can display its wares on your monitor, or send them out to a dot-matrix printer.

**ANITRA** plays Anita's Dance by Edvard Grieg. A beautiful addition to your computer music collection.

**RAMDISK** is one of the most useful utilities you'll ever plug into your PC. Once installed, it creates a virtual drive in memory on your PC. Files can be copied to the RAM-disk and accessed in less time than real drives take to turn on their LEDs.

**Alien** plays a bizarre adventure game and will lead you into some of the most exotic spots in the universe. It comes with a massive data file for an adventure that you won't get tired of 'til the dragons come home for the evening.

**ASMGGEN** is one of the best text disassemblers we've come across. It takes any executable COM or EXE file and produces an assembler listing. It's surprisingly good at distinguishing between code and embedded data or text.

**Jukebox** represents yet another PC music system. This one comes with a host of songs to play and some really electric graphics.

**FOS** is a well designed personal finance manager which will do much to help you tame your cheque books.

**STRUCT** will appeal to the rabid programmer in everyone. It enables MASM to be used to assemble a higher level language. Included also is a test file to illustrate the syntax.

**PRTS** replaces the internal PC screen dump code with something more suited to reality. It allows one to hit the **PrtSc**\* key and then select the print quality from a menu. It supports a number of popular printers.

**BREAKOUT** plays a PC version of the popular game. It will accept input from either a joystick or the keyboard. The graphics are good and the action is adjustable from a beginner's level right up to 'fast and nasty'.

**UTIL** is a collection system utilities which can be accessed from a single menu. Among its many talents are a sorted directory, keyboard redefinition and the facility for scrolling up and down through a text file.

## Volume 1

**PC-Write** An earlier, compact version of this well-known word processor - perfect for program editing. **PC-Write** comes extremely close to equalling the power of commercial word processors costing several hundred dollars. With full screen editing, sophisticated cursor movement, **PC-Write** also boasts features such as user-definable help screens and a 'printer ruler file' which can be customized to work with virtually any printer.

**SOLFE** is a small BASIC program that plays baroque music. While it has little practical use, it's a lot of fun. It's also a fabulous tutorial on how to use **BASICA**'s sound statements.

**PC-TALK** Telecommunications packages for the IBM PC are typically intricate, powerful and huge. This one is no exception. It has menus for everything and allows full control of all parameters. It does file transfers in both ASCII dump and **MODEM7/XMODEM** protocols. And, it comes with a large documentation file.

**SD** This sorted directory produces displays which are a lot more readable than those spewed out by typing **DIR**.

**FORTH** This is a small **FORTH**, written in Microsoft BASIC. A good tool for teaching the ideas and concepts of this esoteric, but useful language.

**LIFE** This is an implementation of the classic ecology game written in 8088 assembler code. While you may grow tired of watching the cells chewing on each other, the source code provides a good example of how to write assembler applications.

**MAGDALEN** This is another BASIC music program. We couldn't decide which of the two we liked better, so we wound up putting both of them on the disk.

**CASHACC** is a fairly sophisticated cash acquisition and limited accounting package written in BASIC. It isn't exactly **BPI**, but its a lot less expensive and suitable for use in many small business applications.

**DATAFILE** is a simple data base manager, written in Microsoft BASIC.

**UNWS** WordStar has an unusual propensity for setting the high order bits on some of the characters in the files it creates. Here's a utility to strip the bits and 'un-WordStar' the text. The assembler source code is also provided.

**HOST2** This program includes BASIC source and documentation files to allow users with SmartModems to access their PC's remotely.

Only \$19.95

Only \$19.95

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Only \$19.95

**MA.BAS** The Micro Accountant is a complete, working accounting and check register program, with a 25K documentation file.

**PCWNDW22 A** "Sidekick"-like co-resident window utility. Pop-up window functions include ASCII table, stopwatch, alarm, printer setup utility and notepad. The entire program takes up less than 30K of space on your disk.

**PSHIFT** A time saving and convenient 'memory partition' utility. Lets you define up to nine memory areas. Load programs such as dBase II and WordStar into separate partitions and 'flip' between them instantly with simple keystrokes.

**PC-TOUCH.BAS** Increase typing speed and accuracy with this easy-to-use typing tutor. Also provides accuracy and speed statistics.

**PCYEARBK.EXE** Appointments and reminder program to help you keep track of your time.

**TASKPLAN.BAS** Project management software which lets you track up to 50 tasks over 50 time periods (days, weeks or months).

**NOCOLOR A** handy little utility for users with monochrome monitors and colour software.

**MAXIT A** simple but subtle game for two human opponents, or one player and the computer. Hours of fun!

NOTE PAD																															
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**PLUS** More utilities to help organize maintain and copy your files, including a "monitor saving" program which blanks out your screen when it is not in use.

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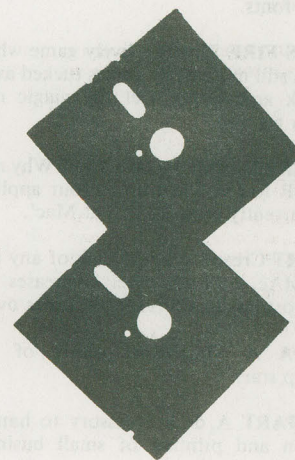
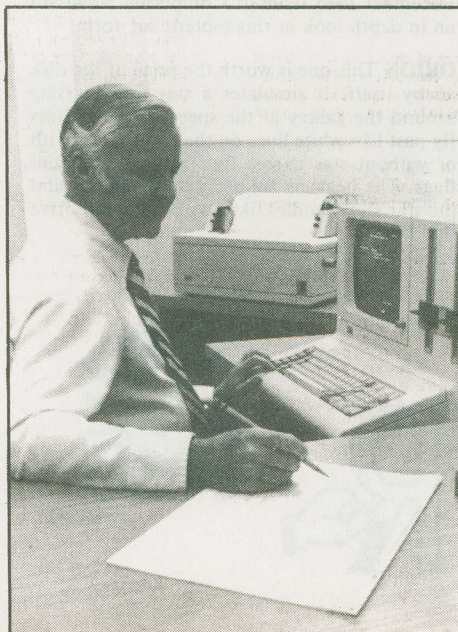
## Stockboy Inventory

**Stockboy** is a good, powerful, flexible bargain-priced inventory package which will handle inventory for most small businesses needs. We use **Stockboy** for our own inventory control and it has stood the test of time.

**Stockboy can:**

- Maintain an inventory database with current, maximum and minimum stock reporting when an item needs re-ordering.
- Be a point of sale terminal, adjusting the stock data base on line.
- Produce individual packing lists.
- Generate a customer list to be used in mass mailings.
- Run on any CP/M or MS-DOS based computer, including Apple II systems with a Soft-card.

**Stockboy** is written in Microsoft BASIC and is designed to be easily altered to suit your needs. It can be compiled using BASCOM if desired and is designed to be used by non-technical operators. Available for MS-DOS/PC-DOS and many CP/M systems.



**Only \$29.95**

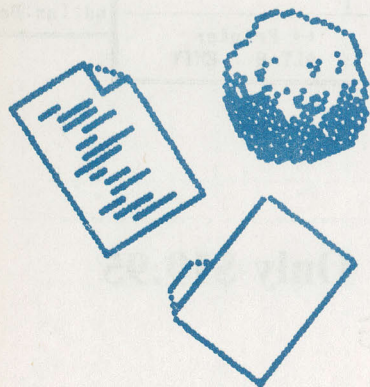
# Almost Free Macintosh Software

Volume 1

**ASTEROIDS** This is a splendid implementation of one of the most popular arcade games of all time. The graphics and sound effects are amazing.

**RED RYDER** Telecommunication on the Mac has never been this easy. RED RYDER includes XMODEM and Kermit protocols and many other features.

**MacCLONE** Many users have found the Mac's disk copy routine to be less than perfect. This is a vast improvement. It even defeats a number of copy protection schemes.



**BINHEX** is a utility for RED RYDER which converts applications files to binary files and back again to allow them to be transferred over phones lines.

**LIFE** is one of the classic computer programs, and this version is exceedingly well done.

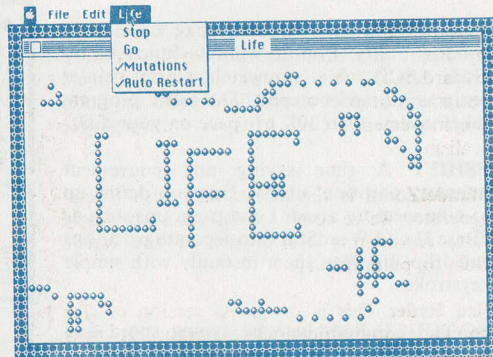
**VIEW PAINT** Ever wanted to look at a MacPaint drawing without getting into MacPaint. This utility lets you sneak peeks at your drawing files without fussing about.

**RESOURCE EDITOR** Macintosh icons and other resource items just cry out to be personalized. This little tool will help you make your Mac look its best for you.

**SCREEN MAKER** Moving text from MacWrite to MacPaint can be a bit disappointing... something gets lost in the clipboard. This utility helps your words make the trip unscathed.

**FONT EDITOR** For those longing to make their own fonts... and for those who just want to adjust the ones they have... this editor lets you shuffle fat bits to your heart's content.

**MENU EDITOR** A handy utility for editing the words in Macintosh application menus.



Only \$24.95

Volume 2

**FONT LIBRARIAN** A splendid alternative to the Macintosh system font mover, this utility makes it easy to create custom collections of Macintosh fonts.

**WIZARD'S FIRE** This is a lively game which comes with still more lively games tucked away in the desk accessories. Get the magic rays before they get you!

**SWITCHER** Multitasking on a Mac? Why not. SWITCHER lets you run up to four applications concurrently on a 512K 'Fat Mac'.

**RAMSTART** Creates a RAM disk of any size on a fat MAC, and effectively increases the speed of most applications several times over.

**MADONNA** A MacPaint picture of the popular pop star.

**MOCK CHART** A desk accessory to handle the creation and printing of small business charts.

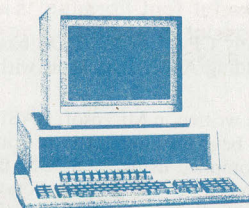
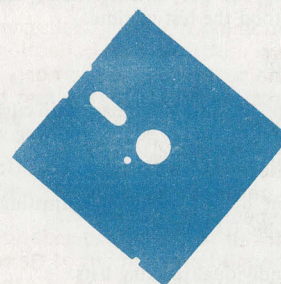
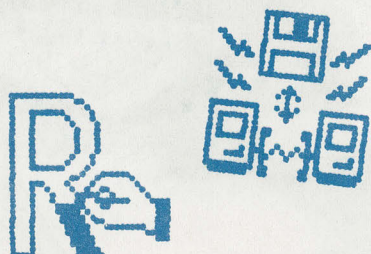
**DAM** A Desk Accessory Manager for setting up the Apple menu on your Macintosh the way you want it.

**MOCK TERMINAL** A desk accessory for telecommunication functions from *within* another application.

**HP CALC** Add a simulated Hewlett-Packard calculator to your Mac.

**REdit** A slick resource editor. See the December 1985 issue of Computing Now! for an in depth look at this esoteric art form.

**ORION** This one is worth the price of the disk all by itself. It simulates a star ship cruising around the galaxy at the speed of light. Stars fly past like white lines on the highway ... with or without star names fluttering like celestial flags. The heavens are accurately mapped and the star ship handles like any other warp drive star Chevy.



Only \$24.95

**Icon Collector** is a peculiar program that allows you to locate icons in applications and capture them to disk for use in other programs.

**Billiard Parlor** is worth the cost of this disk all by itself. It's an excellent simulation of a billiard table. It will play most of the usual variations of pool and billiards, and simulates the movement of the balls with unspeakable realism.

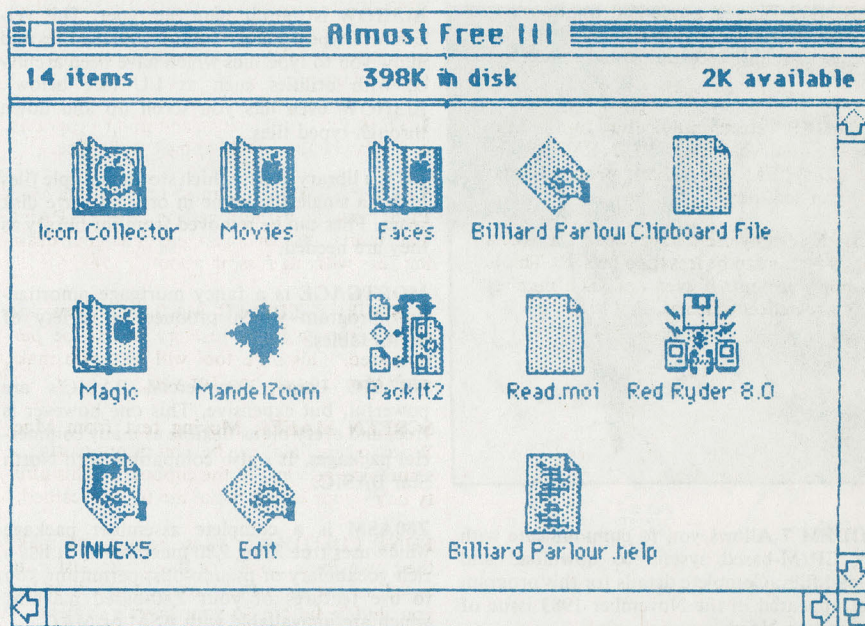
**MandelZoom** is the nicest Macintosh fractal generator we've come across. It's surprisingly fast, considering the nature of the Mac's floating point library.

**Red Ryder** This is the latest version of this popular communications program. It runs perfectly, giving you a sophisticated terminal with download facilities, macros and dozens of other features.

**PackIt2** - not to be confused with PackIt - will compress and uncompress P2T libraries which have been downloaded from bulletin boards. An essential utility for telecommunications.

**BINHEX5** is a file manipulation utility which allows Mac files to be sent over a modem.

**Edit** is the most sophisticated text editor available for the Mac. Operating similar to MacWrite, it allows you to edit documents in multiple windows. Ideal for program editing, Edit produces clean text files which can be compiled.

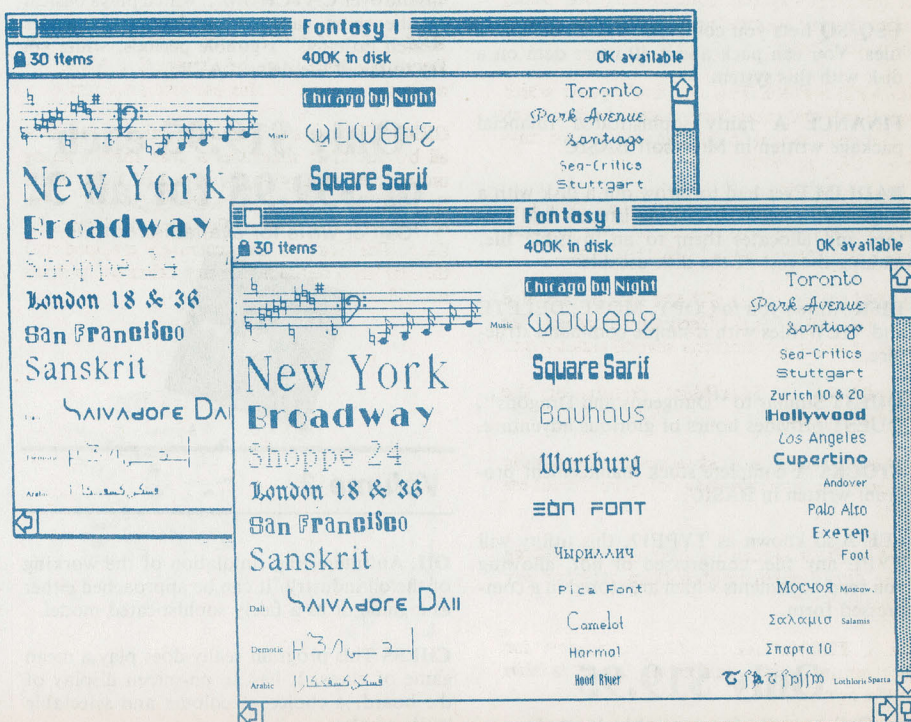


**Only \$24.95**

One of the most interesting aspects of the Macintosh is its ability to use software-based character sets. While there are a number of commercial font packages for the Mac, we feel that this collection of public domain fonts ranks among the best. This disk is filled - to the last byte - with thirty-eight unique fonts. We've selected a variety of body copy and display typefaces, spanning traditional and avant garde designs, along with a number of special purpose sets.

Bid fairwell to the placid exterior of Chicago, the mild amusement of Geneva, the unadventurous disposition of Athens and plug your Mac into this typesetter's pipe dream.

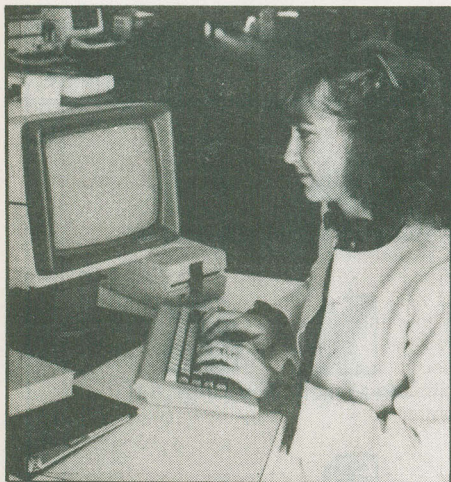
A powerful font librarian is also included to assist in adding the fonts you want to your system.



**Only \$24.95**

# Almost Free Software (CP/M)

## Volume 1



**MODEM 7** Allows you to communicate with any CP/M-based system to download and upload files. Complete details for this program first appeared in the November 1983 issue of Computing Now!

**PACMAN** You really can play PACMAN without graphics... and it works pretty fast.

**FORTH** An up-to-date version of FIG FORTH, complete with its own internal DOS.

**DUU** The ultimate disk utility, DUU lets you recover accidentally erased files, fix corrupted files, and modify the system.

**D A** A sorted directory program that tells you how big your files are and how much space is left on the disk.

**USQ/SQ** Lets you compress and un-compress files. You can pack about 40 more data on a disk with this system.

**FINANCE** A fairly sophisticated financial package written in Microsoft BASIC.

**BADLIM** Ever had to throw out a disk with a single bad sector? BADLIM isolates bad sectors and allocates them to an invisible file, making the rest of the disk useable.

**DISK** Allows you to COPY, MOVE, DELETE and VIEW files with a simple command structure.

**QUEST** Similar to "Dungeons and Dragons", QUEST provides hours of glorious adventure.

**STOCKS** A complete stock management program written in BASIC.

**SEE** Also known as TYPE17, this utility will TYPE any file, compressed or not, allowing you read documents which are stored in a compressed form.

**Only \$19.95**

Call or write for available formats.

## Volume 2

**BISHOW** is the ultimate file typer. This version will type squeezed or un-squeezed files and allow you to type files which have been archived with utilities such as LU (see below). BISHOW even lets you scroll up and down through typed files.

**LU** is a library utility which stores multiple files under a single file name in order to save disk space. Files can be removed from the library as they are needed.

**MORTGAGE** is a fancy mortgage amortization program which produces a variety of useful tables.

**NBASIC** Large, commercial BASIC's are powerful, but expensive. This one however is free, and every bit as flexible as many commercial packages. It's also compatible with North Star BASIC.

**Z80ASM** is a complete assembler package which uses true Zilog Z80 mnemonics. It has a rich vocabulary of pseudo-ops, permitting you to use features of your Z80-based machine which are unavailable with ASM or MAC.

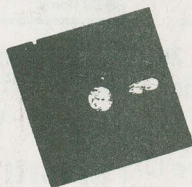
**VFILE** Easily the ultimate disk utility, VFILE gives you a full screen view of the files on your disk and allows you to do mass COPY and DELETE operations using a two-dimensional cursor. It has lots of 'extras', a built-in help file and it's fast.

**ROMAN** Though some say it's silly, this novel little program is a fun way to convert ROMAN numerals into decimal numbers.

**CATCHUM** If you like the fast pace and incredible realism of Pacman, you'll go quietly insane over CATCHUM... which plays basically the same game using ASCII characters. Watch little "C"'s gobble periods, while you try to avoid the delay "A"'s.

**Only \$19.95 each  
or \$39.95 for all 3!**

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## Volume 3

**OIL** An interesting simulation of the working of the oil industry. It can be approached either as a game or as a fairly sophisticated model.

**CHESS** This program really does play a mean game of chess. It has an on-screen display of the board, a choice of colours and selectable levels of play.

**DEBUG** The DDT debugger is good, but this utility adds many new facilities, including symbolic debugging. It's almost like being able to step, trace and disassemble through a source listing.

**DU87** This version overcomes several limitations of the older DUU program and adds some new features. It will adapt to any system and can search, map and dump disk sectors or files. Its invaluable in recovering damaged files too.

**ELIZA** Written in MBASIC, this classic program is a microcomputer analyst. With a little imagination you will be able to believe you are conversing with a real psychiatrist.

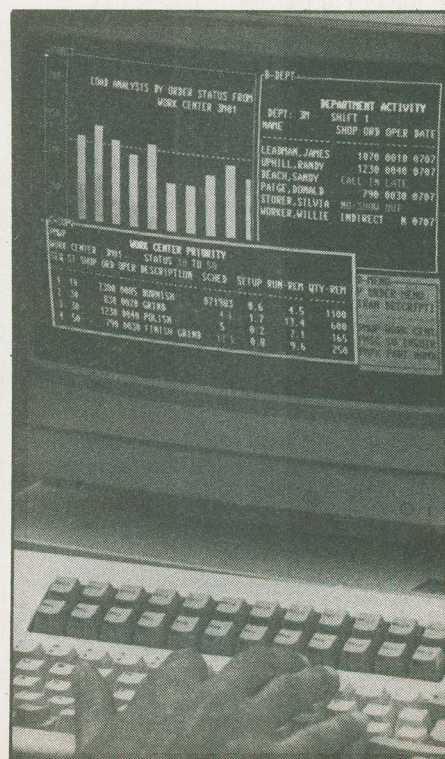
**LADDER** Fast, bizarre and probably a major cause of eye strain. This program plays like Donkey Kong with ASCII characters.

**QUICKKEY** Programmable function keys let you hit one key to issue a multi-character command. This tiny utility lets you define as many "macros" as you want, with seldom used control codes. Keys can be redefined at any time... even from within another program.

**RESOURCE** While a debugger will enable you to disassemble small bits of code easily enough, only a true text based disassembler can take a .COM file and make source out of it again. This is one of the best ones available.

**Only \$19.95**

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A Teacher for the Apple	Almost Free Electronics Design.	Steve's Wunderdisk
<p>Specifically developed for the educational market, this disk introduces both teachers and students to the Apple II series and compatible systems.</p> <p>It is designed to show you how to make the computer work for you.</p> <p>After introducing you to the computer, it goes on to explain the BASIC programming language. With step-by-step instructions it shows you the ins-and-outs of Apple programming and explains the workings of DOS and high resolution graphics.</p> <p>Designed for new computer users, just turn on the computer, slide in disk, and enter the world of Apple programming.</p> <p>Requires Applesoft BASIC, 48K RAM and one disk drive.</p> <p><b>Only \$19.95</b></p>	<p>Contains BASIC utilities for attenuators, highpass and lowpass filters, series and parallel resistors, slew rate prediction, resonant circuits, power transformer selection, audio transformer selection, RMS-average-peak conversions for full and half-wave, transistor selection, and more. Also contains a program for determining the parameters of strobe light circuits; it determines power ratings, time constants, capacitor size, resistor sizes, operating voltages, dissipation and other necessary calculations. Written by Bill Markwick, the editor of Electronics Today, the utilities are not copy-protected and are easily modified to suit the user's requirements.</p> <p>Available for MS/PC DOS with GWBASIC or Apple II systems with Applesoft BASIC.</p> <p><b>Only \$19.95</b></p>	<p>Over the years many first rate program listings have graced the pages of Computing Now!. And we have many which have never been published. We've collected the best of these and put them on one disk. Included are programs like STAR, for setting up a Gemini 10 printer, the Last WordStar Unhook, CPMAP and the CP/M HOST program, complete with several unreleased support programs.</p> <p>The Wunderdisk is an excellent collection of tricky CP/M routines. It's deal for anyone who wants to make their CP/M system sing! And the programs on the disk are well documented... most of them have been explored and explained in the pages of Computing Now!</p> <p><b>Only \$19.95</b></p>

## MDM730 for Apple CP/M

First featured in the July 1984 issue of Computing Now!, MDM730 is one of the most powerful MODEM7 programs available. Our version incorporates features not available in the public domain. MDM730 is an efficient, easy-to-use software tool for anyone interested in telecommunications, bulletin boards and downloading software. Consider these features:

- Terminal program which works at any baud rate.
- Ten programmable macro function keys.
- A Phone number library for 36 numbers.
- Christensen software transfer protocol.
- User selectable toggles for linefeeds, ON-XOFF, etc.
- Extensive help menus.
- Baud rate selection on the fly.
- ASCII dump and capture.
- Status menu.

In addition, we've added dialing support for the Apple version. While the standard MDM730 can not dial unless it's hooked to a Hayes Smartmodem, we've added patches to allow it to do pin twenty-five pulse dialing and to dial through the Hayes Micromodem II and the SSM card. The Computing Now MDM730 will also:

- Select a number form the library and dial it.
- Dial manually entered numbers.
- Log you on to a remote system if it's free.
- Optionally autodial if the remote system is busy.
- Keep track of the number of re-dial attempts.



The Computing Now! MDM730 package is available for:

- The Hayes Micromodem II card.
- The SSM 300 Baud modem card.
- The PDA 232C serial card with external modem.

The PDA 232C package includes versions supporting both the Smartmodem and a dumb modem with pin twenty-five control, such as the Novation AutoCat.

Each package also includes utilities for updating the phone number library and redefining the function key macro strings, as well as an extensive help file.

The source code for this program is over one hundred and fifty kilobytes long and can not be hacked on a standard Apple system. We patched it on a larger machine and downloaded it. We're confident you won't find MDM730 with these features anywhere else.

**Only \$19.95**

Available for Apple II series and compatibles with CP/M

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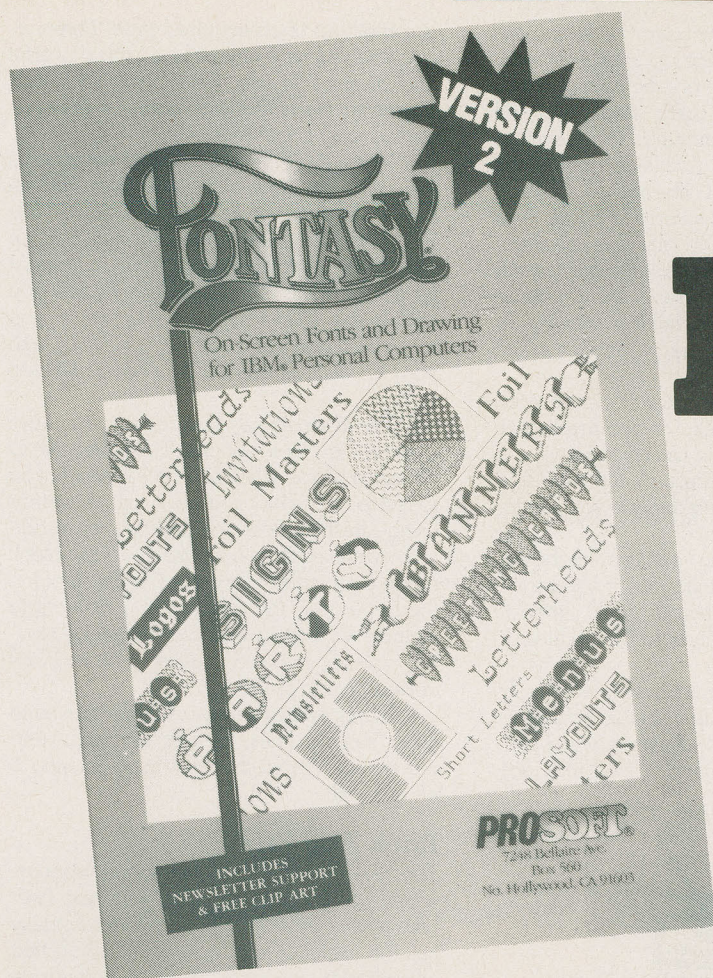
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# The Fontasy Review

by Frank Lenk

**T**here's a lot of really nice graphics software out there these days... but a few programs still have a way of immediately carving a niche for themselves close to your heart. Fontasy, from ProSoft, is one of those programs. Fontasy provides a winning combination of graphics "paint" functions and bit mapped text that makes it totally ideal for personal level desktop publishing tasks.

Amazingly enough, this inexpensive and easy to use program has capabilities easily on a par with most midrange desktop publishing products. It comes closer than anything I've seen to providing PC owners with Macintosh type text and graphic capabilities. Although the PC still can't offer the unified user interface of the Mac, this package is perfectly capable of integrating word processing, graphics and publishing functions into a highly attractive whole.

## Living In A Fontasy

Starting up Fontasy, all you'll see is a blank screen and a flashing vertical line in the upper left hand corner, the text cursor. The system loads a simple font by default, so you can commence typing right away, although the results won't seem all that remarkable.

To really get moving, you'll want to

load some fancier fonts. By default, control and the F1 through F6 keys will each load a useful standard font from the master disk. Control B brings up a menu of fonts on drive B, making it easy to load accessory fonts.

Without going much further, you can use Fontasy as a simple word processor. The arrow keys move around the screen, *home* and *end* go to the ends of the current line, and so on. However, the next level of text commands is largely absent. For instance, the backspace key deletes only the last character typed, then reverts to deleting only one column of pixels at a time. This is inevitable, since text is bit mapped as you enter it, with proportional spacing and kerning... so there's no way for the backspace to know just how much to erase. ProSoft solved the problem to a degree by having the software remember the size of whatever character you entered last... which gives you that one character backspace.

Of course, there are more powerful functions, like block delete or undo, but more of those below.

Fontasy works on a virtual page scaled to match your printer, so pixels map pretty much one to one onto printed dots. This gives it admirable resolution to your output. Additionally, its printed output can be scal-

ed... with separate magnification horizontally and vertically.

Most Epson type printers can be used in quad density mode, which... predictably... reduces everything to one quarter size. I found my Panasonic tended to smear rather badly in this mode. Normal or double struck print seems best. Laser printers can reproduce Fontasy art at a fraction of dot matrix size while retaining the same dot resolution, although the Fontasy scaling options can restore print to a more normal size. In the latter case, you'll get the same resolution as you would from a dot matrix... the dots may look sharper, but they'll be the same size.

The Fontasy virtual page is notably fast and responsive. Scrolling vertically or horizontally... even on a slowpoke PC... is accompanied by only a brief flicker as the screen window shifts and redraws. Using either a mouse or the keyboard you can whip around the entire virtual page more easily than in any of the other systems. Fontasy even allows you to reset the size of the scroll step. You could, for instance, make it finer if you happen to be blessed with a faster computer.

Like most graphics programs, Fontasy benefits from the use of a mouse... or any other pointing device of your choice. It

## The Fantasy Review

handled my SummaMouse in Microsoft mode without complaint. Unlike many other programs, Fantasy leaves keyboard control available even while the mouse is in use. Thus, you make broad strokes with the mouse and still tap a key when you need a single pixel increment.

In general, the keyboard control in Fantasy is unusually powerful. Cursor keys move one pixel at a time, but the F4 key acts as an accelerator to give a larger step from whatever cursor key you hit next. Two taps of the F4 key gives a still larger move. There's even a macro programming option that allows one to assign command sequences to any control key combination.

Fantasy has deliberately structured its keyboard interface so as to use exactly the same commands in both interactive and batch modes. Furthermore, the syntax of embedded Fantasy commands mimics that of traditional WordStar dot commands. The commands are identified by a period in the first column of a line. You use one command per line, appending whatever parameters may be required. Commands can be embedded in a text file or stored separately as a batch program.

The dot commands are entered interac-

tively from the Fantasy editor by hitting the escape key. This brings up a prompt box, asking you for the two character command. Entering a question mark displays a full screen command summary to help you make up your mind. Available commands include obvious stuff like *bf* to begin... load... a new font, *pr* to print a page, *lo* to load a page, and *qu* to quit the program. Any of the disk oriented commands... such as loading fonts or pictures... can be made to provide a menu of available files by including the question mark parameter in the dot line.

More powerful options include the ability to save blocks to disk... in compressed or BASIC format. You can use *pv* to preview a clip art file, paging through the available graphics and then fixing the one you like into place on your page.

The *ke* command initiates keyboard simulation. Anything following it will be interpreted exactly as though you'd typed it interactively... very handy for batch files or within key macros.

Using the dot functions interactively seems a bit strange at first. In this Fantasy is quite reminiscent of the XyWrite word processor... whose command driven interface

is something of an acquired taste. Personally, I find this type of interface both powerful and pleasant to use, though perhaps a bit slower to learn than the more widely accepted idiot proof menus.

Many fundamental Fantasy commands are permanently assigned to the function keys or to alternate key combinations. Thus F1 brings up a status screen, including an reduced scale overview of your full virtual page. F2 does undo. Alternate F2 lets you update the undo whenever you like, so you know just how far back an undo will take you. F3 and alternate F3 provide detailed help.

The alternate key and certain letter keys control the block options. Thus alternate D deletes a block, while alternate S allows you to resize it. The block mode is initiated either using alternate B or the middle mouse button on a three button mouse. Entering block mode selects the first corner of the block... then you drag the rubber band box out to include what you want. Blocks can be moved, copied, deleted, resized, rotated, inverted or mirrored.

The drawing functions include freehand lines, straight lines, rectangles, ovals, and pattern fill. About the only thing missing is an airbrush.

### Rank And File

The real potential of Fantasy only appears when you get into working with text files. Like a lot of other graphics systems, Fantasy has the useful ability to suck up ASCII text and display it using all those frilly type styles. Unlike other systems, Fantasy does this trick with a really fine balance of ease and grace. You won't find yourself swearing under your breath after several hours of fiddling, you will find your text taking shape on the screen in lovely graphic detail.

What makes Fantasy remarkably good with text is the way the text import function is built into and supported by all the other facets of the system. Text formatting is handled by a simple combination of template files and embedded commands. A template is simply an empty virtual page with margins, column divisions and such preset. You can also put simple graphics... like boxes... on your template, so that imported text will know enough to format around them. You can even mark a position for page numbering, and Fantasy will automatically paginate long documents for you.

As your text file is processed, you see the results come up on the screen. The graphic version of your text can be saved page by page, printed immediately or edited using all the Fantasy drawing functions. When importing text, font changes and other special effects have to be performed by embedded commands, so you may want to fool around a bit with the exact positioning of things like section headings.

**FANTASY SAMPLE**

**Pre-shrunk clip art...** and variable margins you pre-defined. Depending on the font size you use, this generally runs at about 200-250 words per minute (remember, we are processing graphic patterns, not simple characters). It goes faster if you turn off kerning.

If the text reaches the end of the page, FANTASY will ask you what to do with the completed page: print, save to disk, ignore, or edit. You can select a different template for the next page at this point, before deciding what to do with the current page. Changing templates lets you use different formats for different pages (we used three columns for the first page here, but you can do this with a ".RD" file instead, but it won't take effect until the next page).

**CAUTION**

Simple templates are simple to use. Designing sophisticated templates, with areas marked off for future photos or illustrations, or with fancy drawings on them, requires some trial and error. Templates are an advanced feature in FANTASY, and we suggest you resist the temptation to make them the first thing you use. We also suggest you plan to spend some time

perfecting your skills with other words, please don't commit to producing an eight page newsletter by noon tomorrow. Even after you master the techniques, you probably will have to format some trial copies before everything falls in place. To save FANTASY trial page to disk afterwards. The command "LOAD" FANTASY will generate unique file names for the pages: PAGE01.PIC, PAGE02.PIC, etc. You can modify these pages on-screen and then print final copies.

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The template feature places restrictions on what you can do. For example, you cannot use UNDO, BLOCKS, drawing, lines, etc., while a template is active, and you should be very cautious about typing text from the keyboard while a template is active. When a template with multiple columns is used, the column margins remain in effect afterwards.

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## The Fantasy Review

The Fantasy editor makes little distinction between text and graphics, so you can edit both using the normal block move operations. In this regard, Fantasy does fall behind proper desktop publishing programs like Personal Publisher, which provide word processing features... such as word move or character delete... even while operating on graphic text. However, Fantasy is an order of magnitude more responsive and more fun to use than "real" desktop publishing software, so it seems a fair trade.

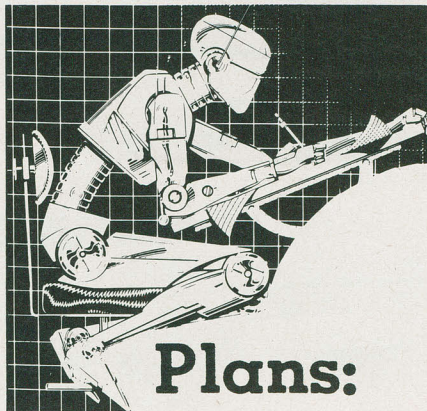
Surprisingly, Fantasy does offer some interactive text formatting. You can justify or center any line of text... whether imported or entered manually... simply by aligning your cursor with that line and hitting alternate J or alternate C.

Fantasy is such a total hoot to play with that you really have to dig to find anything wrong with it. The most serious omission might be the absence of any "fat bits" magnification or zoom for detailed graphic editing. You just have to get close to the screen and squint.

Fantasy also seems incapable of printing other than white on black on the screen or black on white on paper. Inverse printing is something you're unlikely to use often, but it does come in handy now and again. However, you can invert a block, so there's

always some way of getting exactly what you want.

The Fantasy font editor is not included in the basic package. You have to buy something called the Fantasy Toolkit separately. This lets you create or modify



### Plans:

Software: **Fantasy**  
System: **IBM PC**  
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fonts. It also includes a number of neat utilities, such as one that lets you convert saved Fantasy blocks into font characters. Thus you can take advantage of all the Fantasy drawing features when creating your font.

The Fantasy manual explains that the font editor has not been included in the basic kit since most people wouldn't use it. The evidence for this is that of the four thousand people who owned the font designer in 1985, just six had created all of the commercial Fantasy accessory fonts. This argument is fallacious, however. The real usefulness of a font editor is not to supply ProSoft with fonts, but to make life easier for users. For instance, one of the little jobs I've done with Fontrix required a slightly modified version of one of the standard fonts. I had to do the modification by hand on a "one time only" basis. None of my efforts will be available to me for later use, unless I acquire the Toolkit. I would thus consider the Toolkit to be an inevitable purchase for any Fantasy user.

Still, Fantasy is quite a bargain at its current price. It is absolutely perfect for a wide variety of jobs that are too fancy for mere word processing, but not graphically complex enough to require a massive CAD system. Fantasy is one piece of software I think no PC user should be without. **CNI**



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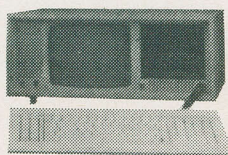


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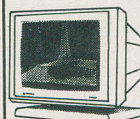
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# The Roland GR System MIDI With An Axe

There is more than keyboards to MIDI.

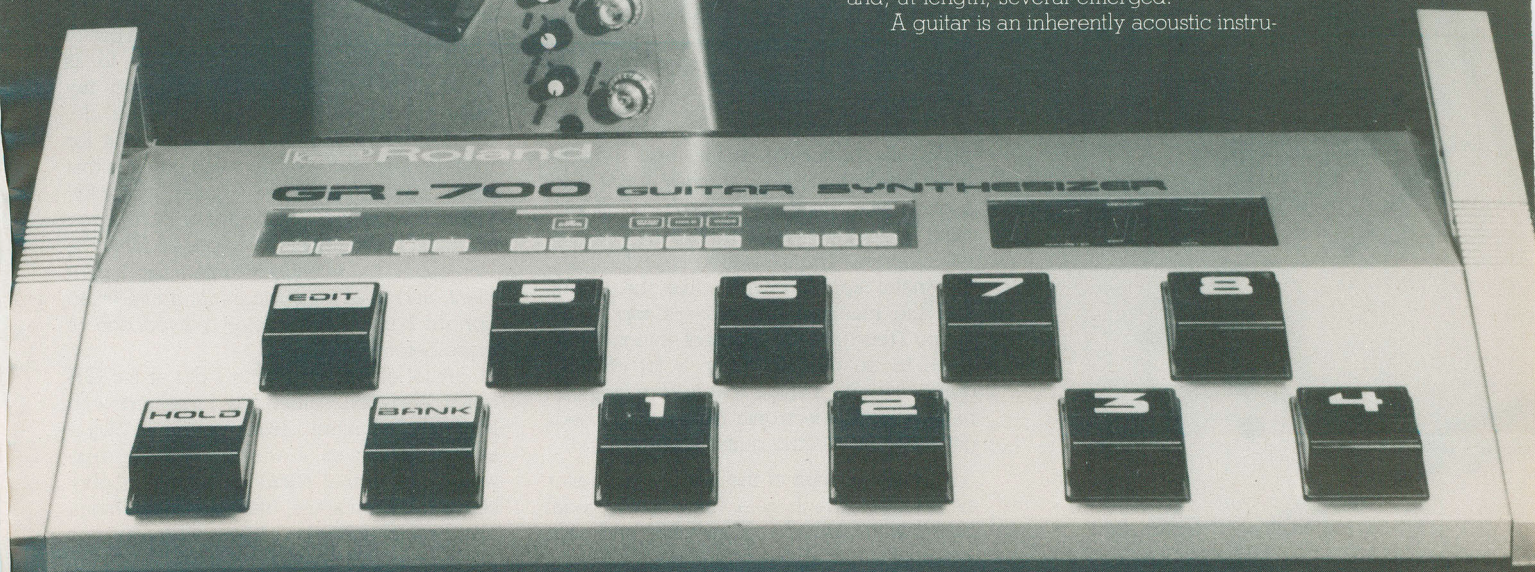
In recent months practical MIDI violins, flutes, drums and, of course, guitars have risen from the mists of Japan. Here's a look at the subtleties of playing a MIDI guitar.

by Steve Rimmer

**W**hen one muses upon the cosmic wonderment of synthesizers, one usually muses on keyboards. Because of their inherently mechanical nature, keyboards lend themselves to being electronically sensed and, as such, to controlling electronic instruments. For a long time, keyboards were the sole meaningful sort of controller one could hope to attach to one's synthetic toys.

Synthesized guitar, that is, an instrument which is played like a guitar but can control a synthesizer, has long been an elusive trip... and there have been some highly weird creations along these lines. With the advent of MIDI, the interest in a practical guitar controller grew noticeably, and, at length, several emerged.

A guitar is an inherently acoustic instru-



## MIDI With An Axe

ment, and, by its nature, funky and unpredictable. This is what makes 'em so interesting to play, and why they're such difficult things to nail down and render as computer data. The latest MIDI compatible guitars probably aren't the ultimate efforts along these lines but, for the first time since human beings first crawled out of their caves and started banging on logs and snare drums, they are more or less playable.

This does, however, depend to a large extent on what you have in mind to play on them. We'll get to that.

There are a number of MIDI guitar systems extant in the galaxy at the moment. Among these are the Ibanez and Roland instruments, and the IVL Pitchrider... which is actually a pickup and a box, to which you add the actual guitar. For the purposes of this feature, we're going to check out the Roland system. This is easy to get, well thought out and playable... an often overlooked facility in MIDI guitars.

### Hexagram

The Roland GR guitar system consists of two bits. The most obvious part is the guitar itself. There are a number of variations on this, from pretty traditional looking Strat

copies on up to the martian squid-harp styled instrument that one normally sees in Roland's ads. I actually got one of each for this article... there is a photograph of the former one here.

It's worth noting that these are actual electric guitars. The Strat copy that I played most of the time while I was "researching" this article... first time in a while I've gotten to research with all the amps turned on... had three normal pickups and the usual assortment of controls. It had a guitar jack, and could be played into a regular amp. It also had a special hex pickup and a twenty-four pin computer interface.

In addition to all these necessities, it had a whammy bar... what a hoot. I haven't played a guitar with one for ages. I killed at least half an hour, very unproductively in researching the whammy bar.

Unlike some of the earlier attempts at a MIDI guitar, the Roland GR axes are actually pretty decent guitars as such. I think that this is fairly important...

I find that the general nature and feel of a guitar affects how

I play it. As a sort of obvious example, I find that the stuff I play on the really weird looking GR instrument comes off sounding very stiff and uptight. It's an uncomfortable guitar to play, or, at least, I find it to be so. It's balanced very strangely, and tends to want to nose into the floor. It's not the instrument to play if you're moved to do Chuck Berry hops across the stage... it'll catch a pedal board or something and pole vault you into the drum risers.

The GR Strat copy, by comparison, plays like a normal guitar, and a rather good one at that. It has a lovely action, with a good solid neck that doesn't feel like it'll wind up looking like a corkscrew in a couple of years. The intonation is perfect, and the metal appointments... like the bridge and the machine heads... are top of the heap. These are the sorts of things which seem to be overlooked in a lot of MIDI guitar designs. I think that before one can have a good electronic guitar, one needs get a decent electric guitar together.

The other half of the band is the guitar synthesizer, which is a huge grey pedal board with pots of foot switches and light

emitting diodes. It is, in fact, a complete sound source... you can play the guitar into it through a special twenty-four pin umbilical cord and it will emit sounds. It has a whole library of editable sounds in there, which can be selected by the foot switches.

The sounds of the GR synthesizer are pretty good and, if you just play it through this box into an amp, you'll probably get a fine impression of it. However, on later reflection, it comes off very well using its own voices because they appear to have been crafted to utilize its abilities while circumventing some of its limitations.

The real promise of a synthetic guitar for me is in that it can be played through other MIDI sound sources, and can generate MIDI information that can be played with using a scoring program, like old faithful Personal Composer. As such, I eventually connected the MIDI out jack of the GR synthesizer into the MIDI in of my DX-7. This was where things started to get a bit less than god-like.

### Continuo

My first attempts to "play" the DX-7 through the GR guitar were abysmal. It mistracked, generated spurious notes, missed whole chunks of music... and generally freaked out at every opportunity. I've made worse noises with things that were designed to play music, but only when I've dropped them from great heights onto a large number of cats.

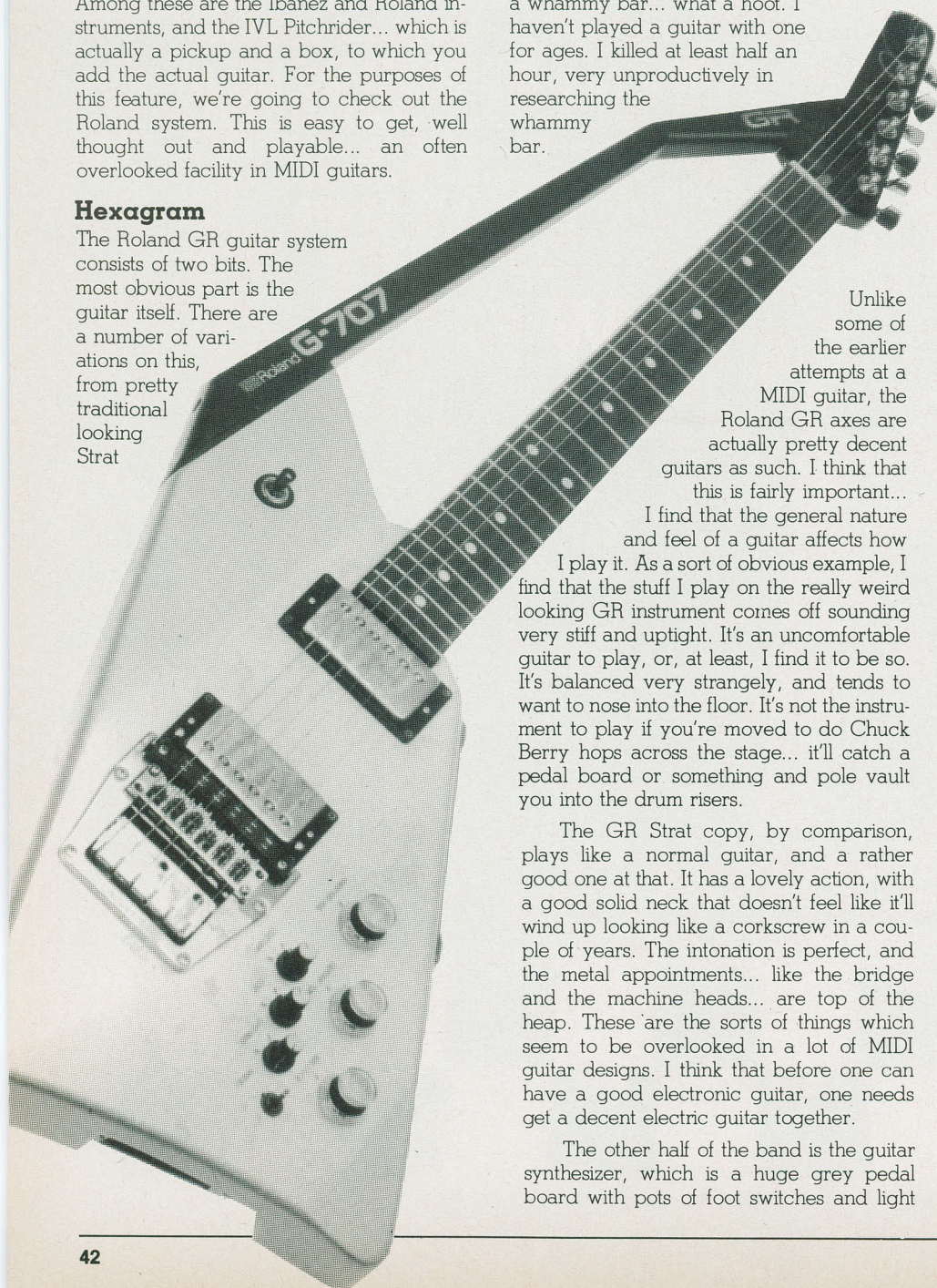
After a while it occurred to me to tune the guitar... not just to itself, which is usually good enough, but accurately, to a fork. This changed its demeanor radically... it had been about a quarter of a tone off, which, on reflection, was about the worst possible situation for it.

Things got a lot better after this.

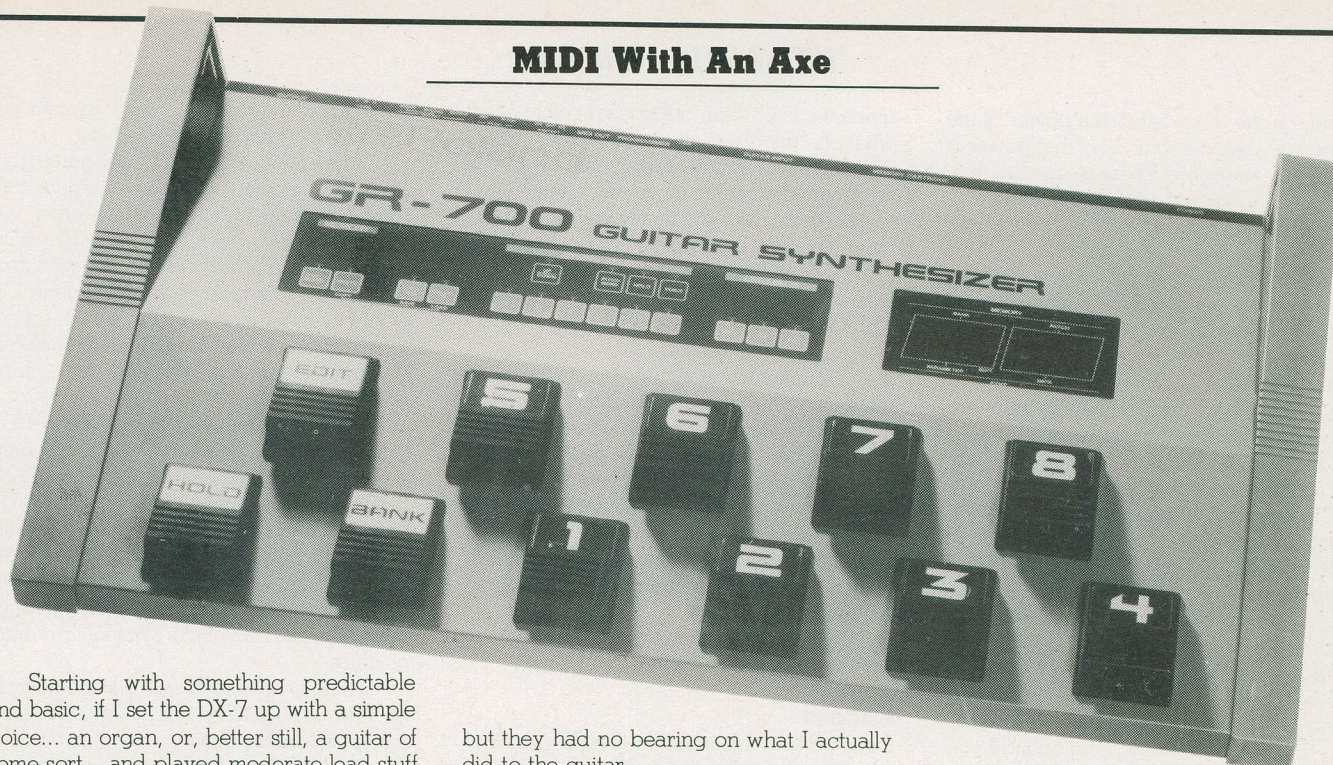
After several eons of playing with the GR guitar and the DX synthesizer, I had the thing exactly where it wanted me. Depending on how you want to look at it, I'd managed to control it or it had done a pretty good job of adapting my playing to its abilities. It had also totally changed my ideas of what I wanted a MIDI guitar to do.

The first thing that will be difficult for most people who pick up a GR guitar is that they'll want to play it like a guitar. It's tricky, in that it looks like one... kind of throws you off. In fact, it's a lot better to pretend that the GR guitar is an entirely unfamiliar instrument, and treat it as you might a lute or an upright bass if you'd never played one of those before.

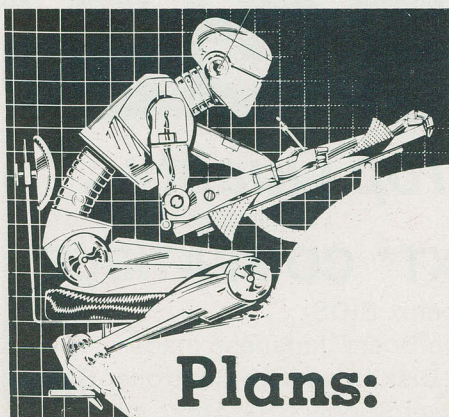
A lot of the screaming I did at the GR guitar early on came... as I realized with later enlightenment... from wanting to play it as the instrument it was not. Just as one would get dismal results in trying to play heavy metal on a lute, there are some things that the GR guitar isn't intended to do.



## MIDI With An Axe



Starting with something predictable and basic, if I set the DX-7 up with a simple voice... an organ, or, better still, a guitar of some sort... and played moderate lead stuff on the GR guitar with nothing too complicated or fast, it responded pretty nicely. It objected to strings left open which hadn't been muted. It got a bit jumpy if I slid my fingers along the strings. If I hammered on a string extremely quickly it would occasionally misinterpret what I'd played and generate a totally uncalled for arpeggio. Some of these were very nice... I certainly couldn't have played them deliberately...



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Synthesizer:	<b>GR-700</b>
Retail Price:	<b>\$3,695</b>
Manufacturer:	<b>Roland Canada Music, 1515 Matheson Boulevard, Unit B12, Mississauga, Ontario L4W 2P5, (416) 625-4880; in Montreal (514) 335-2009, in Richmond, B.C. (604) 270-6626</b>
Availability:	<b>Steve's Music, 415 Queen Street West, Toronto, Ontario M5V 2A5, (416) 593-8888</b>

but they had no bearing on what I actually did to the guitar.

String bending was right out... well, it took on wholly new dimensions with most of the DX-7's voices. If I played a note on one of the lower strings and started to bend the string across the neck, nothing would happen for a while. If I bent it far enough the note would suddenly jump to the next higher integral note. If I kept going I could usually get a third note. This is an interesting effect if it isn't used very much, but it does tend to change the way one deals with guitars in general... it turns blues into light greys.

The whammy bar, of course, is wholly meaningless in this context, having much the same effect as bending individual strings. If you play a chord and hit the bar, the whole chord just gets transposed four or five times. I suppose that this would work very well for some pop tunes, but it sounds like a tape drive malfunction to me.

Applying useable bender effects to MIDI isn't impossible, of course... it just takes a lot of forethought. It also takes synthesizer voices which are designed to accommodate benders well. Much of the stuff in the GR synthesizer will do this... not a lot else seemed to. There are some bender effects that the DX instruments do very well, but I never got them going right with the GR guitar. While I didn't have the Roland alpha Juno keyboard at the time I was doing this feature, intuitively it seems that it would have been better in this respect.

How manageable the GR guitar is with an external MIDI synthesizer seems to be partially determined by which voices one tries to play it with. I found that most short, plucked things did reasonably well. The guitar voices on the DX-7 were great, but a bit pointless if you think about it. Voices with minimal dynamics, like organs or synthetic

leads, also did well, but I had to play to suit them. These lent themselves to long sustained passages.

Horns were also pretty good. Most of the DX keyboard voices, like pianos and harpsichords, didn't fare well with the GR guitar. They got very muddy, and didn't come sounding off at all natural. A few of the solo string voices were good if I was very careful with them, and, in fact, I got a lot of good sounds out of the great seething mess this way. Massed strings were hopeless... there was no advantage to playing them with the guitar rather than the keyboard once one slowed everything down enough to keep them from sounding meaningless.

One of the early rationales I came up with for playing the GR guitar concerned expressiveness. The great joy of a guitar is being able to disconnect your brain and patch your soul directly to your fingers. You can play in weird ways, bend things, stretch things... I used to play with a guy who'd get really into it and very nearly break the neck off his Strat bending that. The GR guitar imposes masses of restraint on one.

To get the GR guitar to sound good, one has to be able to impose a lot more precision on one's playing. In playing a normal electric guitar, one often encounters a situation in which one's technique or approach is obviously wrong, but in which the sound comes out right anyway. In scrutinizing the way I play... in order to adapt my fingers to the GR guitar... I realized that I do this an awful lot. The GR guitar is like some sort of pedantic, mildly evil music teacher in this respect. It doesn't let you get away with anything.

If you can be precise and reasonably

## MIDI With An Axe

careful, on the other hand, the power of the GR guitar is your biscuit, and that power is moderately awesome. There is an incredible range of timbres and sounds available to it that you couldn't even begin to think about with a regular guitar and effects.

You lose gallons of expression, but the ability to play what you're up to with all those voices may well compensate for it.

### More Parts

After a while I got tired of playing lead and decided to get a bit more adventurous. I tried finger picking the GR guitar. This was a bit frightening at first.

Once again, there are "right" ways to finger pick the thing. However, you have to adapt your playing style to it. In this case, I had to really stretch to accommodate it in some cases. It seemed particularly fond of ignoring the lower notes.

After a while, I got used to playing in ways that didn't irritate the synthesizer and I started to get some really interesting things out of it. If you fight with it long enough you arrive at a very clean, careful sort of playing that does seem to suit the music as well as the instrument. Because the DX-7... and any similar MIDI synthesizer... can't really deal with all the nuances and subtleties of a proper acoustic guitar, having forced one to

manually filter them out doesn't really affect what one might have played over the MIDI. The DX-7's sounds, which are usually pretty tight sounding, take on a very interesting feel to them when you finally learn to control them through the guitar. They have the crispness and precision of keyboard noises with a bit of guitar expressiveness to them. The phrasing is un-keyboard like, and interesting for this reason.

Complex picking on the GR instruments isn't unrewarding or all that restrictive... it just forces you to adapt a bit. Purists will maintain that an instrument shouldn't place such demands on its player, and I can relate to this, but the GR guitar isn't a guitar in the proper sense of the word. I'm inclined to want to make allowances for it, as it can do some really splendid things when you do get its act together.

As far as I can tell, there is no practical way to strum a GR guitar.

### Encore

I started out feeling that the GR guitars hadn't really arrived. The GR bass, by comparison, is much more responsive and a lot easier to just pick up and play. This is probably partially because of the way in which one plays a bass, to be sure. However, even the guy at Roland with whom I spoke sug-

gested that they were all a lot happier with the way the bass had worked out.

After playing with the GR guitar for a few days... you really do have to give it that long... it started to come together and become an instrument for me, rather than a handicap. In a sense, this is no different from picking up any other new instrument. One would hardly expect to be able to play a violin the first time. The GR guitar is really a different instrument, despite what it looks like.

While I never got the GR guitar to do some of things I'd had in mind for it, it showed me a lot of other things that it could do, things I hadn't expected or thought of. It's excellent for music which is primarily based on notes, rather than expression. It's splendid for classical stuff, probably for pop, for drifting off into the ozone with, for some sorts of rock. It's very unconvincing at jazz or blues.

The guy at Roland said that there would be new synthesizers for the guitars themselves appearing in the new year, and that they'd do a better job of converting the guitar's dynamics and expression to the precise reality of MIDI information. They should be interesting... there is a lot that a MIDI guitar can do now, but one is constantly driven by wanting to make it do more.

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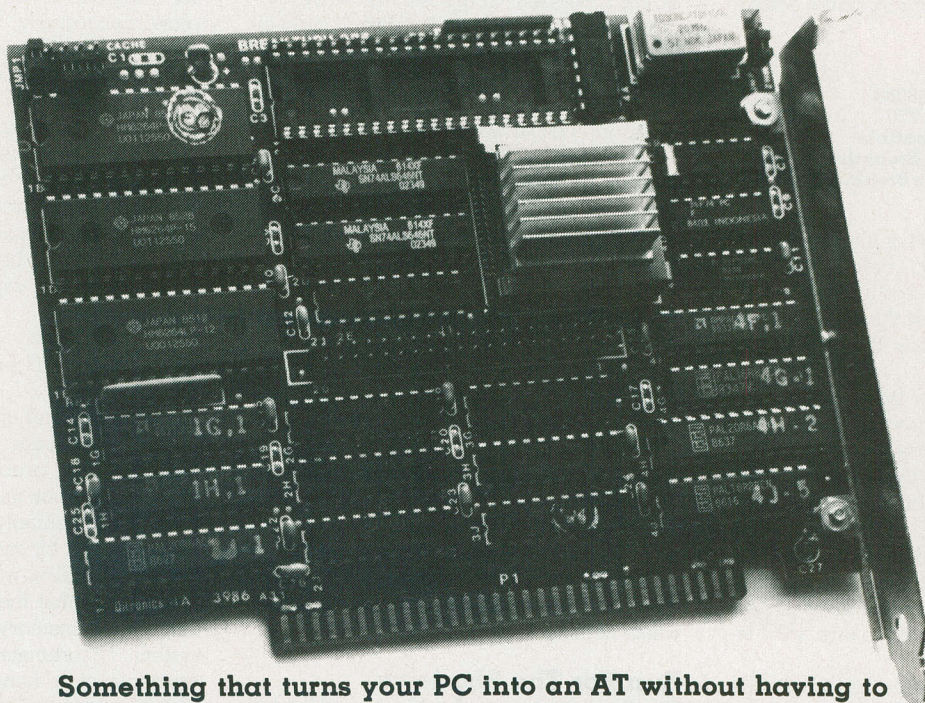
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# The Breakthru PC Accelerator



Something that turns your PC into an AT without having to replace all of its parts seems like some sort of optical illusion in fiberglass. It's mostly true, though.

by Steve Rimmer

**A**fter a while, one gets to be wary of wonder cards. It has something to do with having owned a number of Apple clones, I think. Apples were prime grazing land for wonder cards.

Wonder cards, no matter what they do, all lend themselves to the same sorts of descriptions. A typical wonder card will take your obsolete, slow, hard to use computer and turn it into the state of the art. All it takes is a screwdriver and a Visa number.

My favourite wonder card of all time was the one that made an Apple into an IBM PC. Of course, it didn't actually work, but the concept was so nice.

Apples... when they got stuffed enough with extra fiberglass... were a prime example of the pitfalls of wonder cards. With a few hundred dollars worth of boards, an Apple could have an eighty column screen, a real processor, decent I/O, better disks and all the trappings. However, by the time one had gotten a fruit to the point wherein it was within waving distance of high technology, one usually found that it had become limitlessly funky and unpredictable. In addition, it had usually wound up costing at least as much as a real computer with all the good bits designed in.

The crop of 80286 "accelerator" boards which has sprouted for the PC seems, at least at first reading, to be prime wonder card material, and something to lay down and avoid. These things, if you believe the ads, will make your meandering old PC into something equivalent to an IBM PC/AT. While you don't get the extra memory of an AT, you do get the faster processor and a few gadgets thrown in.

This sounds very, very flaky indeed, and I didn't really want anything to do with these things for a while. The first one I eventually did try made me very happy to have ignored them for so long, and I probably would have left the matter there. The accelerator boards looked to be very expensive and only useful as fly mashers.

The Breakthru 286, from Portable Computer Support Group, was clearly conceived by someone who couldn't spell very well, but who seems to have been able to design hardware with some ability. It's the first of the accelerator boards that I've experienced which has worked in anything more than a theoretical sense. Not only did it manage to hang in there long enough to run the benchmarks, it actually handled real

software without crashing or behaving peculiarly.

In addition, far from being a classic wonder card, it actually did speed things up enormously without imposing any real penalties on my computer.

In this feature we're going to look at accelerator boards in general and this little jewel in particular.

## Just Like Rabbits

The system I flung the Breakthru at was a Best PC compatible with a 4.77 megahertz clock, which is a pretty standard, pedestrian computer. In fact, the latest crop of PC compatible systems use eight megahertz clocks, so things improved rather more for me than they might for you.

I don't like benchmarks for most hardware evaluations. Usually, all you wind up learning is how fast the thing will run benchmarks... which isn't much help unless you're a code freak. However, there are a lot of factors that affect the speed of complex software, and, after some consideration, I decided to give in and zap the thing with the sieve of Eratosthenes, a time honoured way of generating useless prime numbers.

## The Breakthru PC Accelerator

This program effectively measures the speed of execution of whatever it's running on, as it does a lot of calculations. I wrote it to read the system clock before and after its deliberations, and tell me the number of one hundredths of a second that had elapsed in the interval.

The results were a bit surprising, actually.

<b>Dusty old PC with an 8088</b>	<b>1049</b>
<b>Less dusty PC with a V20</b>	<b>1011</b>
<b>Best AVT PC/AT compatible</b>	<b>247</b>
<b>Dusty PC with 8 MHz Breakthru</b>	<b>236</b>
<b>Dusty PC with 10 MHz Breakthru</b>	<b>209</b>

I should explain a bit of this. My PC, as it first came out of its box... before it got dusty... had an 8088 processor in it. This is the first value. Actually, I lost the 8088 it came with months ago... I took this one out of something else.

The V20 is a slightly faster 8088 clone chip from NEC, which, as you can see, does improve the performance of the system a bit. It does other things, too... you can read about it in the May 1986 edition of *Computing Now!*.

The third line is a Best AVT 286 eight megahertz AT compatible, which is a seethingly fast computer, and more or less what this board is supposed to turn a PC into.

The next line represents the PC with the Breakthru in it. It actually outperformed the real AT by a bit.

Finally, the Breakthru comes with a sixteen megahertz crystal in it, making the board itself run at eight, but there was a box full of pink foam in with mine which turned out to contain a twenty megahertz one. There didn't seem to be any instructions about what it was there for, but replacing the sixteen megahertz crystal with it did juice the system even further, as it was now running at ten megahertz.

The crystals are socketed affairs... you don't have to do anything as gauche as soldering to experiment with them.

The Breakthru more or less quadrupled the speed of my old PC for pure calculations.

The thing doesn't have anything like this much of an effect on some real life software. Much of the time a PC takes to do things is tied up in screen updates, disk reads and so on. The improvement the Breakthru brings to these sorts of functions is notable, but not quite so dramatic. A data base manager, for example, would probably get the least benefit from this card. Programs which do things primarily in memory, such as spreadsheets, some word processors and so on, are the most effective places to apply an accelerator.

Unlike most of the accelerator boards I've looked at, the Breakthru 286 didn't seem to bring any software incompatibilities

to my PC. I tried a lot of the sorts of things that almost work on almost compatible systems, all without having it barf once. Well, actually, it did have one minor problem, but that was a bit weird and easily avoidable. I'll get to it in a second.

One of my recent favourite nasty programs is Personal Composer, the MIDI scoring package. It's nasty... it makes a fairly effective compatibility test... because it's very, very large, and gobbles even larger quantities of memory. It also fiddles the screen buffer in unusual ways.

Personal Composer not only ran without a hitch on the PC with its accelerator board in place... it was wholly mind blowing. Its screen refreshes were genuinely instantaneous, compiling huge scores took no time at all and it played as flawlessly ever. It's worth noting that things which use the system timer tick to regulate their speed... such as Personal Composer... don't start clipping along at four times their usual speed under this thing. As such, MIDI music doesn't suddenly start sounding like chipmunks, and video games remain on impulse power.

I didn't get a chance to try the Microsoft flight simulator... a very good test of compatibility... with the system, as my PC has a Herc card in it, which the flight simulator wants nothing to do with.

### Run For The Shadows

The Breakthru card, as with all accelerator boards, is a bit more involved to install than, say, a memory expansion board. It entails ripping a chip or two from your PC. To this end, the package comes with a chip ripper, a little bent strip of aluminum which assists in removing the appropriate packages.

In order to get the board installed, one must extricate the 8088 from one's motherboard, as the 80286 on the Breakthru board will ultimately replace it. If there's an 8087 math co-processor in your PC it'll have to go too. This is one of the few unpleasant aspects of using the Breakthru... it obsoletes this very expensive chip, requiring that you pop for an 80287, an even more expensive chip, if you want to continue having a math co-processor in your system. The Breakthru has a socket for an 80287, but doesn't come with one living there.

The 8087 socket gets plugged up with a dummy chip... it's supplied with the package... and the 8088 takes a header which connects it to the card. It's a good trip to put the header in first. It's also worth checking that it went where it was intended to go... it's fairly easy to get it offset by one pin.

The card itself lives in an expansion slot. It has unusually short connector fingers. This seems to make it a bit easier going in... although it also makes it very easy to wiggle loose. Even if you don't usually bother to bolt cards into your PC, it's worth doing so

for the Breakthru if you haven't long since lost all the machine screws.

There are two things to set up on the board, to wit, some jumpers and the aforementioned crystal. The board that I got came with the slower speed crystal installed. It's probably a good idea to run it with this for a while until you're sure that it's trucking along comfortably. The crystal's right at the top of the card, and is easy to swap over later without removing anything.

The crystal was actually the cause of the one glitch I experienced with the Breakthru. It sits in a chip socket, but only just manages to hang in there. It can squirm out if it's provoked by sufficient vibrations. A cheap fan seems to be sufficient... a few disk selects may also do it. When the crystal drops, the board goes into vapour lock and bids the world farewell.

A bit of tape... or a few disk write protect stickies... will keep the little monster in there.

The other set up consideration is a collection of jumpers which set the memory caching. You probably don't know why you'd want your memory cached... I'll explain it momentarily. This set of jumpers, however, is a bit critical, as if it's set wrong the PC probably won't boot. It's supposed to be set so that the jumpers represent the amount of memory that's really in your system. Unfortunately, they only go in increments of a hundred and twenty-eight kilobytes, and stop at six hundred and forty K. This latter bit is a drag if you've cheated and installed seven hundred and four.

The board seemed to work if I set the jumpers up for less memory than I really had... it choked if I lied to it and said I had more. Actually, it was quite happy thinking I had no memory at all... the system ran fine, although slightly slower than at its maximum revs.

There are two extra jumpers which allow you to cache other areas of the PC, to wit, the extra RAM and ROM area at segment 0C000H and the BIOS, at segment 0E000H. Now, these are a bit more mysterious than the rest of the system, and are probably best left off at first. On a normal PC there won't be anything at the first area. If you have Lotus Intel AboveBoard type memory card, this jumper will confuse it if it's turned on. The second one does result in some improvement in the performance of the BIOS... this mostly results in the screen updating a bit faster... but has the arguably negative aspect of making many computers hang every time you try to boot them if it's enabled.

This is only a drawback if you want to use your computer.

There is a way around this, actually. You're supposed to leave the jumper physically off and run a little utility after the PC has gotten itself awake to change the jumper setting in software. Predictably, the

## The Breakthru PC Accelerator

utility is included with the card. This all works well, and is probably worth doing, especially if you have a hard disk system where the inclusion of the utility won't really gobble a meaningful amount of space. However, I was quite happy with the performance of the PC with the Breakthru in it and the BIOS un-cached.

### Cache Box

The primary concept of an accelerator board is having a fast 80286 processor in one's system. The 80286, the guts of the PC/AT, is just a much more sophisticated trip. It has an internal architecture which both increases the speed at which it executes instructions and allows it to run at a higher clock speed than does a stock 8088.

In fact, this is only part of what accelerator cards do. The other part is the addition of a cache to the system. There's a bit of technical stuff involved in understanding what this is... if you don't really care, you can skip over the next few paragraphs.

The normal memory in a PC is relatively slow. There are "wait states" involved in its use... the same thing that makes it cheap enough to have half a megabyte of it on your motherboard also makes it slow down from time to time to get refreshed and tidied up.

When the processor of a PC is running a program, it has to "fetch" the bytes of the program from the memory in which it resides. Each fetch takes time, and, because the system memory is slow, the time the processor spends fetching contributes considerably to the overall time it takes to do whatever you've put it up to.

A cache cheats on this a bit. It's possible to get "fast" memory. It's too expensive to have a whole PC full of it, but you can own a few K of it without having to mortgage the cat. The cache gets connected to the processor with some dedicated cheating logic so that it can be accessed by the 80286 very much faster than can the system's memory.

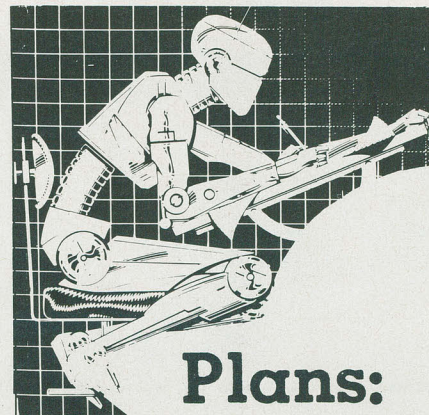
Whenever the processor fetches a byte, it gets put in the cache as well as being executed. The next time the processor goes to fetch a byte, the cheating logic checks to see if that byte has been previously cached. If it exists in the cache it can be fetched from there much more rapidly, and, as such, the effective speed of the processor will improve.

In a theoretical sense, this gives with one hand and takes with the other. The cached bytes are fetched faster, but the time it takes to fetch a byte from the system's memory is slightly longer with the cache going, because the cheating logic has to think a bit every time a byte is requested by the processor. Because of the nature of programming, however, just about all code experiences some degree of speeding up with a cache.

The Breakthru board does allow one to disable the caching, of course, if it happens to be slowing down one's programs.

The Breakthru manual notes that the power up memory test... a BIOS function... isn't cached, because you usually can't set the BIOS to be cached in hardware. If you want it cached you have to run the aforementioned utility to do so, which obviously can't be executed until the memory test is complete and the system boots DOS. As such, the memory test slows down a bit as a result of the caching feature.

The size of the cache memory determines, to a large extent, how much of a difference the cache will make to your system. A bigger cache means that the board can hold more bytes, and has to resort to the system's memory less often. The Breakthru board has a sixteen kilobyte cache, which is probably the largest one around at the moment.



Hardware: **Breakthru 286**  
Manufacturer: **Portable Computer Support Group, 11035 Harry Hines Boulevard, #207, Dallas, Texas 75229, (214) 351-0564**  
Function: **Accelerator board for IBM PCs and compatibles**  
Price: **\$395 US**

There are a couple of other fairly clever aspects to the Breakthru board. It runs its cache memory at eight megahertz, a bit faster than the usual speed of seven and a bit, which is derived from the colour burst frequency of the PC's video section. This improves its performance somewhat. It also does some clever cheating in the way it loads its cache when the processor requests a byte of data, rather than a word, and pushes the pedal a bit closer to the floor as a result.

I couldn't tell you how much faster WordStar will run as a result of these innovations.

In addition to the Breakthru card itself, the package also includes a copy of a utility called Lightning. This more or less does for floppy disks what the cache memory does for the processor. Whenever a disk sector is fetched, it gets copied into memory as well

as being handed to whatever called for it. As such, if it's called for again, it can be snatched without actually resorting to the disk. Lightning builds up a cache of recently used sectors.

Lightning does seem to do what it says, and obviously, it's a profound improvement for programs that read the same sectors over and over again. I don't have any of these that I know of. Lightning didn't do much for me, but, being free with the Breakthru board, didn't pose much of an inconvenience either.

### Breakdown

I was very impressed with the Breakthru. Aside from its inherent financial unpleasantness over the loss of my 8087 and the fact that it gobbles a slot... I have slots to burn, however... it seems to impose no penalties on the system as a result of its use. It meant that I had to give up some of the more esoteric joys of a having a V20 chip in the system, but, then, I haven't used any of the V20's features since about a month after I got it.

The Breakthru's benefits in speed are almost godlike. If you try a real AT, you'll realize that this is what PCs are supposed to work like. In some respects, my PC with the Breakthru board is just a bit better than a fast AT compatible.

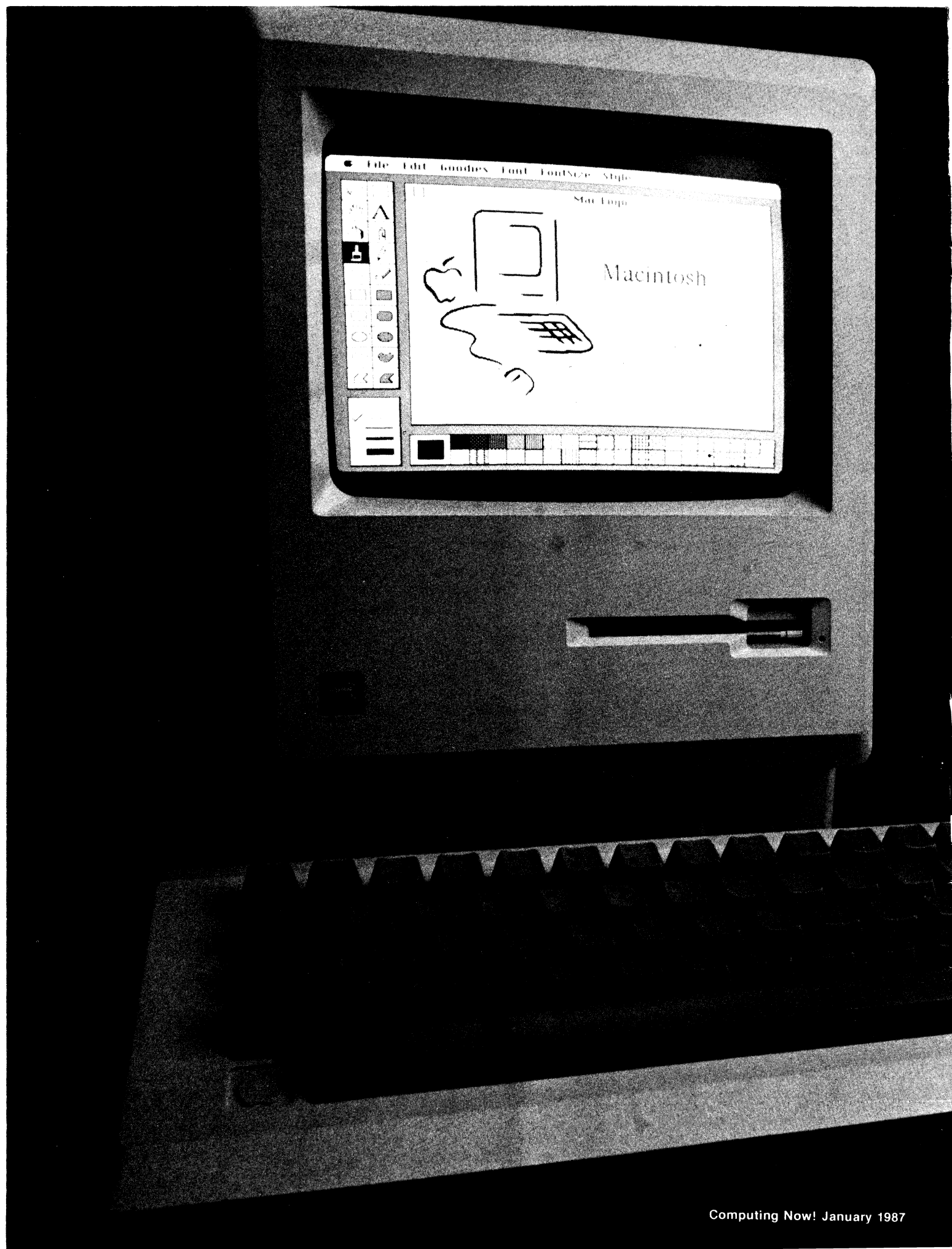
There are, unquestionably, some things that a PC with a Breakthru can't do that an AT can. The most notable of these is that such a system can't access the high memory that the AT addresses with its extra slots. If you use Lotus with large spreadsheets... the most commonly encountered reason for wanting an AT with lots of RAM... the Breakthru won't cut it. If you don't, this probably won't matter. I've never used the high memory in an AT for anything other than a RAM disk, and then only 'cause it was sitting there doing nothing else.

One fairly subtle point is that, while a PC with a Breakthru card in place can run code written to use the 80286's extended instruction set, the PC itself is designed to be driven by an 8088. As such, its BIOS is written in 8088 code, and the faster processor won't run the PC BIOS anything like as quickly as it would a BIOS written for an AT. As such, BIOS related things... mostly screen activity... won't run as fast on an accelerated PC as they would on a real AT.

The other feature of an AT which won't be immediately present in a mutated PC is the high density drives. Oh, yes, and you won't get a set of those trendy round keys, either.

These limitations notwithstanding, the Breakthru is a serious gas, and well worth checking out if you've been reaching the limits of your PC of late. Far from being just another wonder card, it offers realistic improvements for systems which have slipped a bit behind the state of the art.

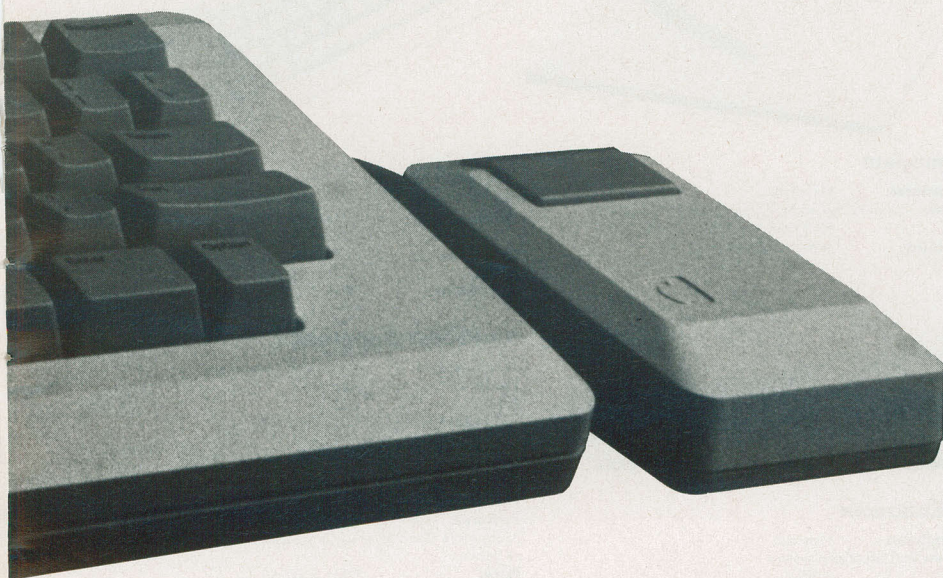
CNI



# Survey of Macintosh Hardware

Here's a look at some toys and boxes to make your Mac even friendlier... but that's friendly, not downright foolish, so we left out such goodies as the stick-on, fake fur bunny ears! Such is the price of dignity.

by CN! Staff

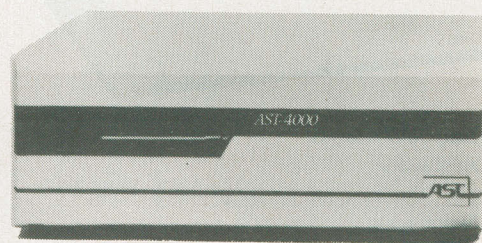


## Arcturus Large Screen Projection systems

**Manufacturer:** Arcturus  
**Features:** Various sizes from five feet to about eight; includes 67 inch rear projector.  
**Requirements:** Mac interface \$350.00  
**Price:** Starts around \$10,000 to \$19,500 (projector)  
**Availability:** Electralert

## AST-4000

**Manufacturer:** AST Research  
**Features:** Seventy Mb hard disk subsystem with tape backup and SCSI compatibility.  
**Requirements:** Mac Plus  
**Price:** \$12,495 (includes MacServe)  
**Availability:** McKenzie Brown Canada



## AST-2000

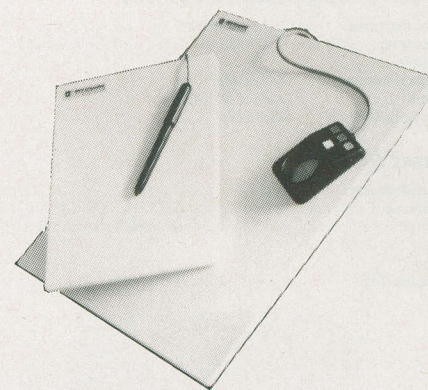
**Manufacturer:** AST Research  
**Features:** Twenty Mb of SCSI compatible mass storage with tape backup.  
**Requirements:** Mac Plus  
**Price:** \$4,395 (introductory offer)  
**Availability:** McKenzie Brown Canada

## Bernoulli Box

**Manufacturer:** Iomega  
**Features:** Mass storage device uses removable cartridges, starting at 20 Mb.  
**Price:** Starts at about \$2,800, excluding controller  
**Availability:** Compuserve

## Digi-Pads

**Manufacturer:** GTCO  
**Features:** Digitizers, using RS-232 serial ports, various sizes.  
**Price:** \$691 (6x6); \$17,000 (42x60)  
**Availability:** Electralert



## GVC Super 12 Modem

**Manufacturer:** GVC  
**Features:** Direct connect modem, 300/1200 baud, Hayes compatible; includes cable.  
**Price:** \$399  
**Availability:** Gentek Marketing

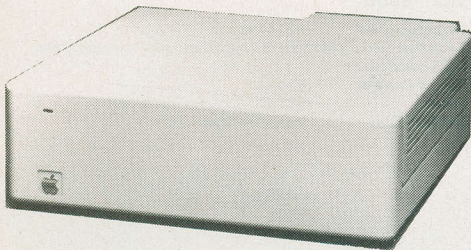
## Habadisk

**Manufacturer:** Haba Systems  
**Features:** Hard disk.  
**Price:** \$683  
**Availability:** Ingram Software

# Survey of Macintosh Hardware

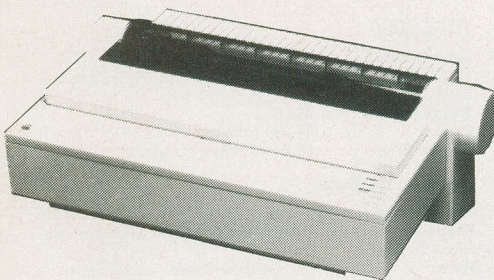
## Hard Disk 20

**Manufacturer:** Apple Canada  
**Features:** External hard disk, 20 Mb; includes driver for ImageWriter, and File System software; (Hard Disk 20 SC includes SCSI port \$2,195)  
**Requirements:** Mac 512K  
**Price:** \$1,965  
**Availability:** Authorized Apple dealers



## ImageWriter II

**Manufacturer:** Apple  
**Features:** Dot matrix printer, 250 cps in draft, 45 cps NLQ; seven-colour ribbons available; 10" or 15" carriage widths.  
**Requirements:** Assy kit  
**Price:** \$1,045  
**Availability:** Authorized Apple dealers



## Kraft QuickStick

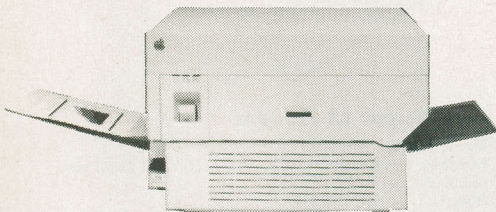
**Manufacturer:** Kraft Systems  
**Features:** Switch selectable joystick and mouse modes; two and three button models.  
**Price:** \$131  
**Availability:** Ingram Software

## Laser Graphics Slide System

**Manufacturer:** Laser Graphics  
**Features:** Slide system, 2000 line resolution, works with various software.  
**Requirements:** Mac or Mac Plus  
**Price:** Starts at \$13,433  
**Availability:** Electralert

## LaserWriter

**Manufacturer:** Apple  
**Features:** Laser printer, 8 pages/minute; 300 by 300 dpi; supports PostScript, includes 500K ROM; upgrade to LaserWriter Plus 1 Mb ROM \$1,310.  
**Price:** \$8,195  
**Availability:** Authorized Apple dealers



## Logic Board

**Manufacturer:** Apple Canada  
**Features:** Memory expansion board, one megabyte; increases mere Mac to Mac Plus; must be installed by authorized dealer.  
**Requirements:** M2516 ROM and Drive Kit  
**Price:** \$900 (for 512K Mac)  
**Availability:** Authorized Apple dealers

## Mac 10/20

**Manufacturer:** Paradise Systems  
**Features:** External hard disk drives, plugs into modem or printer port.  
**Price:** \$1,710 (10Mb); \$2,395 (20Mb)  
**Availability:** Ingram Software

## Macaccessories Portable Modem

**Manufacturer:** Kensington Microware  
**Features:** Small, battery-powered modem.  
**Price:** \$248  
**Availability:** Ingram Software

## MacDrive

**Manufacturer:** Haba Systems  
**Features:** Hard drive, 800K.  
**Requirements:** Mac Plus  
**Price:** \$650  
**Availability:** Ditek Marketing

## Mac Drives

**Manufacturer:** Tecmar  
**Features:** Ten Mb fixed drive, or five Mb removable.  
**Price:** \$3,678  
**Availability:** Ingram Software

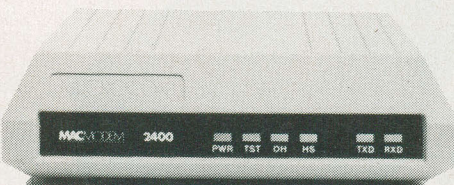
## Macintizer

**Manufacturer:** GTCO  
**Features:** Electromagnetic digitizer plugging directly into mouse port, needing no special software; can be used instead of or with mouse.  
**Price:** \$766 (list); optional passthrough mouse cable \$75  
**Availability:** Electralert



## Macmodem

**Manufacturer:** MicroCom  
**Features:** 300/1200 bps and 2400 bps, Hayes compatible.  
**Price:** \$1,235 (300/1200); \$1,765 (2400)  
**Availability:** Ingram Software



## MacEnhancer

**Manufacturer:** Microsoft  
**Features:** Port expansion system.  
**Price:** \$145  
**Availability:** Microsoft Canada

## Macintosh External Drive

**Manufacturer:** Apple Canada  
**Features:** External floppy drive, 800K, DSDD; accepts single sided disks.  
**Requirements:** Mac Plus, Mac 512K with 800K internal drive upgrade, or Mac 512K with Update software  
**Price:** \$655  
**Availability:** Authorized Apple dealers



## Mac Plus Disk Drive Upgrade

**Manufacturer:** Apple  
**Features:** Internal upgrade for floppy drive.  
**Price:** \$490  
**Availability:** Authorized Apple dealers

## Macintosh Plus Keyboard Upgrade

**Manufacturer:** Apple  
**Features:** New keyboard, also available in French.  
**Requirements:** Mac Plus  
**Price:** \$215  
**Availability:** Authorized Apple dealers



## MacServe

**Manufacturer:** InfoSphere  
**Features:** File server to be attached to hard disk, allows separate volumes to be created with password protection.  
**Requirements:** Hard disk  
**Price:** \$315 (FST incl.)  
**Availability:** Blumer-LeVon

## MacSurge Suppressor

**Manufacturer:** Kensington Microware  
**Features:** Surge suppressor.  
**Price:** \$91  
**Availability:** Ingram Software

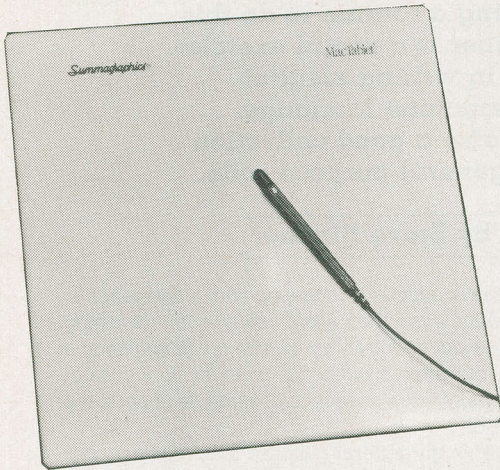
## MacViz

**Manufacturer:** MicroVision  
**Features:** Video digitizer, including black and white camera, micro zoom video lens, lighted copystand, manual software and all cables.  
**Price:** \$464 (FST incl.)  
**Availability:** Blumer-LeVon

# Survey of Macintosh Hardware

## MacTablet

**Manufacturer:** Summagraphics  
**Features:** Graphics tablet, connecting to modern port; compatible with all Macintosh software; includes stylus.  
**Price:** \$625 list (6x9); \$995 list (12x12)  
**Availability:** Parity Plus



## Net Commander 16

**Manufacturer:** Digital Products  
**Features:** Clusters any 16 devices, various configurations.  
**Price:** \$3,275 to \$5,000  
**Availability:** Electralert

## NetWay 1000A

**Manufacturer:** Tri-Data Products  
**Features:** Gateway for connecting Macs to IBM mainframe under AppleTalk network.  
**Price:** \$5,395  
**Availability:** McKenzie Brown Canada

## Omninet Network Interface

**Manufacturer:** Corvus Systems  
**Features:** LAN interface enables Macs to connect with Apple IIs and IBM PCs; full spooling capabilities for laser printers.  
**Requirements:** Mac Plus needs special cable  
**Price:** \$395  
**Availability:** Corvus Systems (Canada)



## P2400

**Manufacturer:** Novation  
**Features:** Modem, 2400 bps, includes MITE software.  
**Price:** \$1,581  
**Availability:** Ingram Software

## PC MacBridge

**Manufacturer:** Tangent Technologies  
**Features:** Short card connecting directly to AppleTalk Network cable, enabling Apple products and PCs to share peripherals such as printers and file servers.  
**Price:** \$895  
**Availability:** McKenzie Brown Canada

## PC MacKey

**Manufacturer:** Tangent Technologies  
**Features:** Replacement keyboard, AT style layout with numeric/cursor pad; supports Microsoft Word.  
**Price:** \$459  
**Availability:** McKenzie Brown Canada

## Penmouse

**Manufacturer:** Kurta  
**Features:** Graphics tablet and pen; cordless, battery-powered pen and thin tablet.  
**Price:** \$550.00  
**Availability:** Authorized Amiga dealers

## PhoneNET

**Manufacturer:** Farallon Computing  
**Features:** An AppleTalk LAN using ordinary phone lines modular connectors, cables and accessories.  
**Requirements:** Mac 512K or Mac Plus  
**Price:** \$99 (connectors); \$20 (PhoneNET AppleTalk adaptor)  
**Availability:** McKenzie Brown Canada

## Popcom modems

**Manufacturer:** Prentice Corporation  
**Features:** Various baud rates.  
**Price:** Starting around \$800  
**Availability:** Ingram Software

## Printsharing devices

**Manufacturer:** Digital Products  
**Features:** Four-to-one printer-sharing device, with and without buffer.  
**Price:** Starts around \$856  
**Availability:** Electralert

## Professional Series

**Manufacturer:** Summagraphics  
**Features:** Professional-sized MacTablet, 18 by 12 inches.  
**Price:** \$1,803 list (FST incl.)  
**Availability:** Atelco

## Quark QC-10/20

**Manufacturer:** Quark  
**Features:** External hard drive, allows multiple volumes, password protection, can run ProDOS, Mac in different volumes.  
**Price:** \$1,995 (10Mb); \$2,695 (20Mb)  
**Availability:** McKenzie Brown Canada

## Series ONE

**Manufacturer:** Kurta  
**Features:** Graphics tablet with built-in power supply; available in three sizes.  
**Price:** \$895 to \$1,595  
**Availability:** Authorized Amiga dealers

## System Saver Mac

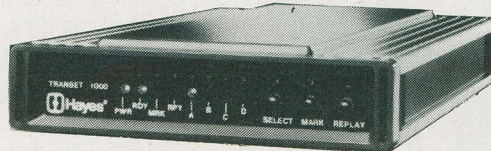
**Manufacturer:** Kensington Microware  
**Features:** Surge suppressor and fan, with two power switches.  
**Price:** \$177  
**Availability:** Ingram Software

## Thunderscan

**Manufacturer:** Thunderware  
**Features:** Scanning device which takes place of ribbon cartridge in the ImageWriter printer; results may be saved as Paint documents.  
**Requirements:** ImageWriter printer  
**Price:** \$464 (FST incl.)  
**Availability:** Blumer-LeVon

## Transet 1000

**Manufacturer:** Hayes  
**Features:** Functions as an intelligent printer buffer, communications buffer, port expander and I/O switcher.  
**Requirements:** Mac Accessory Kit \$65  
**Price:** \$655 (128K); \$895 (512K)  
**Availability:** Compuserve



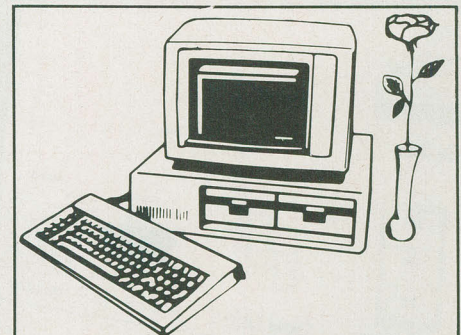
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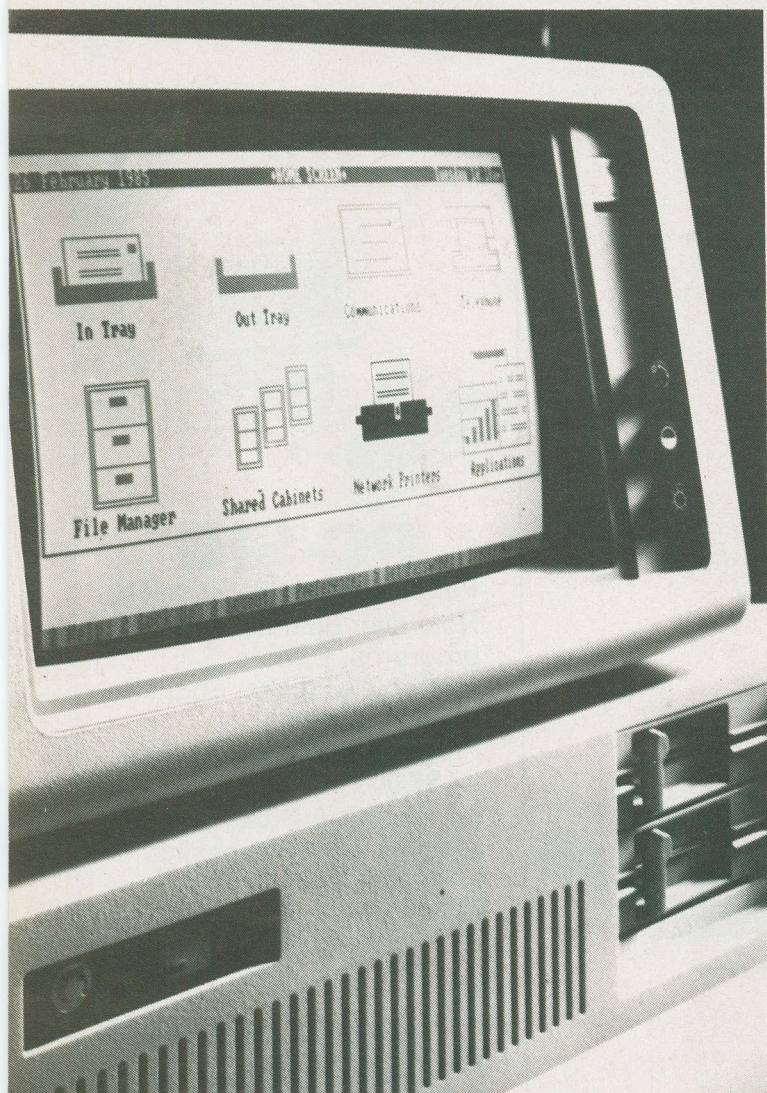
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# Quest for the Perfect PC Date Function



**While you might not care whether your programs print the date with grace and sophistication, getting a routine to do this together is a useful exercise in writing elegant machine language. It's also a good collection of general purpose code.**

**by Steve Rimmer**

**S**ometimes it's fairly difficult to come up with a theme for articles... especially when they aren't really about anything. This one started out as a treatise on string manipulation in assembly language, but after a while the walls of its enclosure started to bulge. It's really just a collection of odd bits of code that I'm particularly fond of.

If you generate enough general purpose machine language subroutines... and put them somewhere where they won't get lost... you'll wind up with a sort of higher level language. This is not to say that it'll be easy or particularly elegant to write in. User friendliness is for trogs. However, you can have a lot of the facilities of C or BASIC without having to write massive amounts of code every time you crack open a program editor.

Part of having a reasonable environment to write assembly language code in, is tied up in simply getting a decent rationale and strategy together for things. You can often save yourself a lot of subsequent digital agony by planning everything in advance. Barring this, swipe someone else's plans.

In this feature we're going to look at some plans and the code that results from them.

## **It All Started With A Blind Date**

Much of the programming in this article got written as a result of a very tiny bit of code which grew to enormous proportions. At the moment the source file is about twenty-five kilobytes long, although I'm certain it will get much bigger. It's mostly a non-program... that is, it doesn't actually do anything, although it's been enormously fun to write thus far.

It was snowing a lot last week up where I live. There wasn't much else to do.

The beginning of this enormous program can be found in the observation that this bit of code

```
MOV     AH,2AH
INT     21H
```

will cause MS-DOS to read the PC's clock and return the system date. The date comes back in the AX,CX and DX registers. The DL register holds the day, the DH register the month and the CX register the year. The AL register is the day of the week.

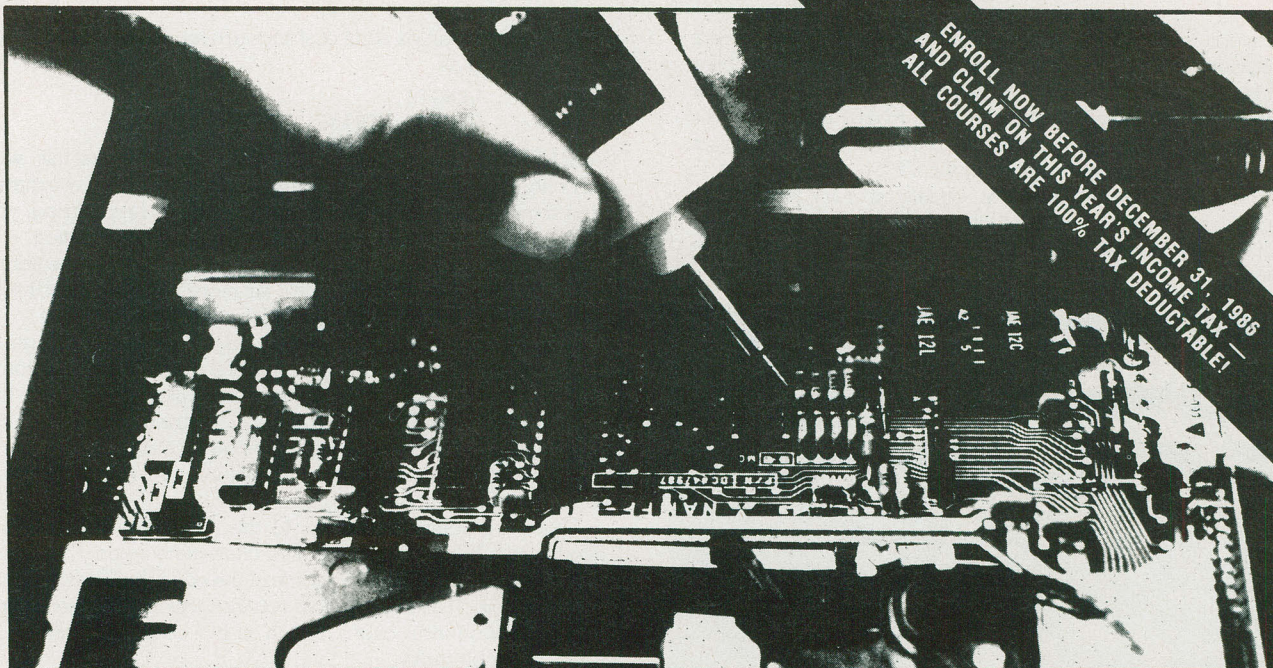
Of course, all of this is in a fairly meaningless form... it's in nasty binary numbers. I thought it would be handy to expand it out to something more human, like

Monday, November 24, 1986

The first thing that this problem begs is a way to print strings. This is where we can start looking at all that forethought.

The most obvious way to print strings at the assembly language level is to use the DOS print function, that is

```
MOV     AH,9
MOV     DX,OFFSET STRING
INT     21H
```



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## Quest for the Perfect PC Date Function

This assumes that the string exists somewhere in the current data segment, and that it's terminated by a dollar sign. The dollar sign may seem like an arbitrary choice for a terminator, and not a terribly good one at that. For one thing, it makes printing prices for things a bit tricky. It's actually a throwback to the days of assembly language programming under CP/M... you may have heard of CP/M... for which it was an equally arbitrary terminator.

Actually, different environments define strings in different ways. It's worth checking out a few to find the most useful one for our needs.

The most complex sorts of strings are found in BASIC, which defines a string as

```
DB      LENGTH
DW      OFFSET STRING
```

The BASIC interpreter maintains a table of things like this, with each one containing the length and location of an unterminated string somewhere in memory. In other words, to find a string, you find its entry in the table and then derive its actual location.

This is a good trip for BASIC, which likes to move the actual contents of strings around a lot. It's far more complex than things need to be under assembly language most of the time.

The string storage under Pascal is much simpler. It consists of a length byte followed by the contents of the string. This has some advantages under assembly language, as it allows us to know the length of a string without measuring it. The string is as long as the length byte says it is. In knowing the length of a string without any heavy juggling, we can make practical use of the 8088's string manipulation instructions.

There are some drawbacks to this. Strings of this sort are limited to two hundred and fifty-five characters in length, which, in turn, imposes constraints on some of the code that's designed to work with them. It also means that routines which can't use the string manipulation instructions... such as I/O code, for example... have to get a bit funky.

Pascal style strings work well on machines which are heavily into index registers, such as the 6502 that runs the Apple II+. Better approaches are available on the PC.

The strings that are used under C... and, incidentally, what we'll be looking at in this article... consist of strings of bytes terminated by nulls. The string is as long as the space between where it starts and where the first zero byte is. As one never has cause to print character zero, this doesn't impose upon us the sorts of hassles that using a dollar sign for a terminator does. It means that strings can be of any length there's room for. It also means that they can be manipulated conveniently with pure pointer math. For example, if the SI register points to a six byte string, you can have the rightmost three bytes with [SI + 3].

In addition to all this, the higher DOS service functions treat strings this way... what the manuals call ASCIZ. That peculiar little abbreviation doesn't actually stand for anything. It means, literally, an ASCII string terminated by a zero.

This bit of code prints a character in the AL register to the screen of the PC. It gets its act together though DOS, so it's glacially slow, but at least it's predictable.

```
PUTCH:  PUSH    DX
        PUSH    AX
        MOV     AH,2
        MOV     DL,AL
        INT     21H
        POP     AX
        POP     DX
        RET
```

Everything subsequent to this code prints to the screen through it. This is conceptually rather comfortable, as you can change it later on if you have to. For example, you could use the code from the fast video article in the October 1986 edition of Computing Now!

Having gotten this together, we can print a string in memory fairly simply. The SI register will be used to point to the string.

```
PUTS:   PUSH    SI
        PUSH    AX
PUTS_1:  MOV     AL,BYTE PTR [SI]
        CMP     AL,0
        JE      PUTS_2
        CALL    PUTCH
        INC     SI
        JMP     PUTS_1
```

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## Quest for the Perfect PC Date Function

```
PUTS_2: POP     AX
        POP     SI
        RET
```

This code is typical of the sort of string handlers one writes for null terminated strings. You don't have to use the AL register at all unless you're actually doing something with the contents of the string. If you're just looking for the end of it, for instance, you can

```
LOOP:   CMP     BYTE PTR [SI],0
        JE      LOOP_1
        JMP     LOOP

LOOP_1: ...
```

You would print a string, then by doing

```
MOV     SI,OFFSET STRING
CALL    PUTS
```

This is a very convenient way of dealing with strings, being similar to the way things are handled in C. One defines a string by a pointer to the beginning of it. As such, one can store references to lots of strings in a small space... all you need is two bytes for each pointer... and do a lot of string manipulation with the most trivial of pointer arithmetic.

Now, getting back to this day of the week exercise, the first problem is to get an English word based on the value in AL, which ranges from zero for Sunday on up to six for Saturday. This seems fairly simple. First, let's define the words.

```
DAY_NAMES: DB     'Sunday',0,0,0,0
            DB     'Monday',0,0,0,0
            DB     'Tuesday',0,0,0
            DB     'Wednesday',0
            DB     'Thursday',0,0
            DB     'Friday',0,0,0,0
            DB     'Saturday',0,0
```

Now, there are actually several ways in which we could do this. It would probably be conceptually nicer to use a bunch of random length strings and a table of pointers into them, but this means typing more stuff in. This approach uses a table of strings of constant lengths. The string "Sunday" is shorter than "Wednesday", but, by padding them out with zeros we can make them the same. Note that every string has to have at least one zero after it to make it printable.

If the SI register is set to point to the start of the first string, then, and the AL register holds the number of the day we want to see, SI + (AL \* 10)... the strings are ten bites long... will point to the right string. This is the actual code.

```
WEEKDAY: PUSH    AX
          PUSH    CX
          PUSH    DX
          MOV     SI,OFFSET DAY_NAMES
          MOV     AH,0
          SUB     DX,DX
          MOV     CX,10
          MUL     CX
          ADD     SI,AX
          POP     DX
          POP     CX
          POP     AX
          RET
```

Call this, followed by a call to PUTS, and the right day of the week will show up. Here's the whole SEE\_DATE subroutine.

```
SEE_DATE: MOV     AH,2AH
          INT     21H

          CALL    WEEKDAY
          CALL    PUTS
          MOV     AL,' '
          CALL    PUTCH
```

```
MOV     AL,' '
CALL    PUTCH
MOV     AL,DH

CALL    MONTH
CALL    PUTS
MOV     AL,' '
CALL    PUTCH
SUB     AX,AX
MOV     AL,DL
CALL    ITOA
MOV     AL,' '
CALL    PUTCH
MOV     AL,CX
CALL    ITOA
RET
```

Along with the WEEKDAY routine, we'll also need something similar to print the names of the months.

```
MONTH:   PUSH    AX
          PUSH    CX
          PUSH    DX
          MOV     SI,OFFSET MONTH_NAMES
          MOV     AH,0
          SUB     DX,DX
          MOV     CX,10
          MUL     CX
          ADD     SI,AX
          POP     DX
          POP     CX
          POP     AX
          RET

MONTH_NAMES: DB     'January',0,0,0
            DB     'February',0,0
            DB     'March',0,0,0,0,0
            DB     'April',0,0,0,0,0
            DB     'May',0,0,0,0,0,0,0
            DB     'June',0,0,0,0,0,0
            DB     'July',0,0,0,0,0,0
            DB     'August',0,0,0,0
            DB     'September',0
            DB     'October',0,0,0
            DB     'November',0,0
            DB     'December',0,0
```

If you look at this code carefully... or if you try to assemble it... you'll notice that it has a call to an as yet undisclosed subroutine called ITOA. If you look at this long enough, you'll realize that this is supposed to print out the actual date, to wit, a number. This routine, then, converts a binary integer to ASCII, hence its name. In other words, it's a decimal output routine.

Converting a number in a register to a character string that represents it to normal humans is one of the more difficult things to do elegantly in machine language. Base ten mathematics are something which microprocessors rarely like having to do, and we have to go to some length to convert numbers that are comfortable as binary into decimal. More to the point, the problem tends to work itself out in reverse.

The number 415 means, in the purest sense, five times one plus one times ten plus four times one hundred. To break a binary number down into ASCII, then, we have to reverse this process, finding out how many times a number can be divided by one hundred, how many times the remainder can be divided by ten and so on.

Unfortunately, when you write code to do this, you ordinarily wind up having the digits available in reverse order... a galactic drag. It's fairly easy to store them in a buffer somewhere, and print them out the right way around, but it's hardly elegant. More to the point, it's also wasteful of both time and code space.

You can create a right ways 'round conversion program, although you have to go to weird lengths to do it. The resulting

## Quest for the Perfect PC Date Function

code, however, is compact and neat, although it's a little hard to understand at first.

```
ITOA:      PUSH    AX
           PUSH    BX
           PUSH    CX
           PUSH    DX
           MOV     BX,AX
           SUB     DX,DX
           MOV     CX,10
           DIV     CX
           CMP     AX,0
           JE      ITOA_1
           CALL    ITOA_1

ITOA_1:    MOV     CX,10
           MUL     CX
           SUB     BX,AX
           MOV     AX,BX
           ADD     AL,'0'
           CALL    PUTCH
           POP     DX
           POP     CX
           POP     BX
           POP     AX
           RET
```

This is an example of one of my favourite weird programming phenomena, recursion. It's fun because it's so hard to get working properly, and so slick when it finally does do what it's supposed to. In fact, decimal conversion is fairly trivial, and this thing worked first time.

Recursive routines are those which call themselves. You can see this one do it right before the label ITOA\_1. Every time it calls itself, it creates a new set of register variables for its latest iteration... saving the old ones on the stack... and goes and calls itself again.

This sounds like a disaster, of course. Recursive code only works if there is some factor that will halt the recursive process after a suitable number of iterations. In this case, it's the number of digits to be printed. This code can't call itself more than five times.

When this code is called, the number to be output is in the AX register. We do a test division by ten... the original number is preserved in BX. If the result is zero, the conversion is complete. Otherwise, the routine calls itself, saving the results of the first call on the stack, and repeats the process.

When the AX register becomes zero as a result of being divided by ten, the most recent iteration of the call jumps to ITOA\_1. This bit of code derives the value of BX MOD 10 by multiplying the previously divided value in AX by ten and subtracting this from the unaltered value in BX. This value will range from zero to nine, the appropriate digit involved. In fact, we don't want a binary value, but rather, the appropriate ASCII character of "0" through "9". This can be derived by adding the ASCII code for "0" to AL. Assuming that we are converting what will be a three digit number, the first time this arrangement prints something we'll see the number of hundreds in the number, then the tens, and finally the ones.

Having printed its digit, this iteration returns. This means that the program counter will now be set to the instruction after the call, that is, to ITOA\_1, with the registers set up as they were for the next to last iteration, wherein the whole process will repeat itself.

The numbers are still generated in reverse order, but they get pushed up on the stack as they're derived, and popped off in the order we want them.

This sort of code can have a nominal saving in speed over less sneaky approaches. While it does in fact stash the numbers in a sort of buffer, it actually uses stack space rather than a fixed chunk of RAM... the advantage being that when it's done the stack memory can be used for other things.

The only hassle in this is that it requires a reasonable amount

of stack overhead. It takes five words of the stack for each iteration, or a maximum of twenty-five words for a number which turns out to have five ASCII digits.

This routine will only unpack numbers up to 65536, that is, numbers up to what can live in a single sixteen bit register. It's not that much more difficult to write a long integer to ASCII conversion routine if you want one... the MUL and DIV instructions of the PC can be made to handle thirty-two bit math without an undo increase in the code involved. However, the stack overhead requirements will double.

This sort of code can also handle conversion to other bases once you understand how it works. To convert a binary number so it shows up in hexadecimal, for instance, you would have to replace the tens with sixteens. Actually, division by sixteen, which is an even power of two, can be handled very much more efficiently with logical shifts. This code

```
MOV     CX,16
DIV     CX
```

will have the same results as

```
MOV     CL,4
SHR     AX,CL
```

The latter effort, however, will take several hundred clock cycles less time to get its act together.

The other problem with hexadecimal conversion is in converting the resultant binary digits... which run from zero to fifteen... into the nasty and non-consecutive hex digits, which run from "0" to "9" and then from "A" to "F". This is another of those applications wherein pointer manipulation can do things so easily.

Consider this code.

```
HEXD:     PUSH    SI
           MOV     SI,OFFSET HEXS
           MOV     AH,0
           ADD     SI,AX
           MOV     AL,BYTE PTR [SI]
           POP     SI
           RET

HEXS:     DB      '0123456789ABCDEF'
```

If we replace the line ADD AL,0' in our modified hexadecimal ITOA routine with a call to HEXD, AL will return with the appropriate hex digit all ready for printing. This code uses the value of AL as an index into a string.

If SI is set to point to a string of hex digits, as we do in this routine, the distance from the start of the string to any character in it will be equal to the hexadecimal magnitude of the value of the distance. That sounds a bit like high school math, I know. If you add the actual binary value of the digit you want to SI, SI will point to the corresponding hex digit. It's effectively a crude sort of lookup table.

### Back Dated

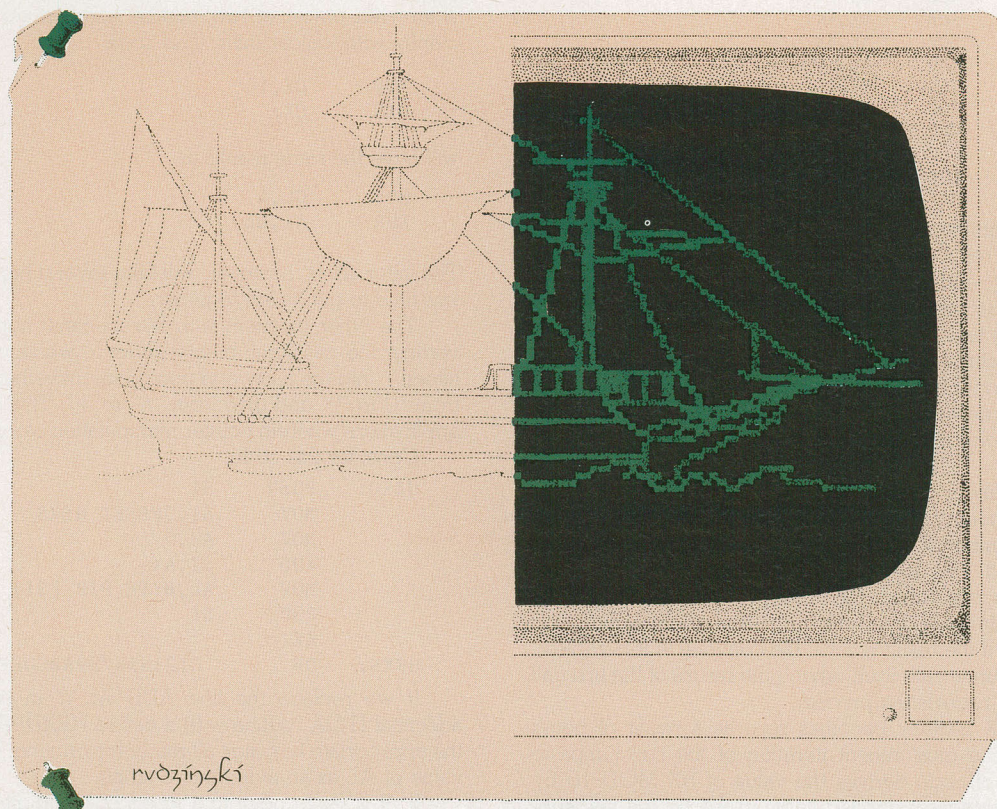
You might not need the ultimate date routine... a few terse numbers will usually do. However, this code illustrates a number of bits of code that can be applied to other programming problems.

Large, complex and painfully thought out solutions to seemingly simple problems may seem like heavy overkill... in a sense they are, but they can also be seen as a good excuse for applying one's self to developing powerful functional subroutines and applying one's brain to writing slick, efficient programs.

There are, of course, still more trivial problems which can be the basis of even larger programming efforts. Consider the problem of writing the time in flowing italicized script plotted on a high resolution screen. Now there's a *really* quixotic waste of time.

CN!

# High Resolution Graphics in C



**While it has no graphics facilities of its own, C is amenable to acquiring some. Here's a look at a high speed graphics module for the PC which creates a workable, consistent programming environment.**

**by Steve Rimmer**

One of the things that real C purists consider to be a great virtue of C... and just about everyone else curses at... is that C has no intrinsic graphics facilities. It's great for handling data, pretty decent at text, splendid at program control... but it doesn't want to know about pixels.

This, of course, makes C very portable, because every computer on the planet has its own way of dealing with high resolution graphics. It solves the compatibility problem by ignoring the issue.

This lack of built in graphics functions doesn't mean that C can't handle graphics,

of course... just that one must write graphics functions for one's particular environment. As such, C retains its innocence and portability, having shrugged off the machine dependent stuff to the rest of us.

Some of the more interesting computers, like the Macintosh, have intrinsic graphics facilities built in. The C compilers that have been written for these machines just tap into code that already exists on the system. In the case of the IBM PC, however, there are no useful graphics routines on the system to speak of. As such, we have to get the graphics primitives together before we can look at writing graphics software.

In this feature we're going to have a look at the techniques for writing high speed graphics code to handle points, lines and rectangles from C. The code I've included with this article will support both the colour graphics adapter and the Hercules card... you can change it if you have an EGA card and want to use it in one of its higher resolution modes. The routines are very modular, and are largely independent of the actual card you use.

## **Strategy**

The first thing that one must decide, in planning a set of graphics functions, is exactly

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## High Resolution Graphics in C

how they should behave. If you're used to the graphics in Microsoft BASIC you'll probably have a feel for what graphics can be like when this isn't done. The graphics commands in BASIC are funky and irregular, and, as such, programming with them takes a lot of trial and error.

The graphics environment of the Macintosh... the "QuickDraw" functions... are quite a bit less fuzzy. While these things take a lot of getting used to if you've been into BASIC for any length of time, the results are arguably worth it. You can write much more intelligent code, which doesn't lend itself to the bugs that seem to creep into BASIC. More to the point, it's a great deal easier to implement these sorts of functions in C, as their rationale takes into account the strengths of a compiled language.

I'll explain a bit more of this in a while.

There is a function in the PC's BIOS which allows it to plot high resolution pixels on the screen with nothing more than a few lines of code. As this function can be accessed from C with the *int86()* function, it would seem like it has been handed down from the gods for an application like this. Clearly, if one can plot pixels on the screen one can do all the more complex functions.

The only hassle in this thing is one of time. As with all the PC's BIOS functions,

this code is tediously, mindlessly, glacially slow, and doing complex plotting with it, in which large numbers of pixels must be turned on or off, can be a good excuse to boot up a second computer and work on something else for a while. As there is no way to juice this little guy up to any meaningful degree, we aren't going to be using it here.

Besides which, it doesn't support the Herc card.

One of the things that's nice about the PC is that its screen buffer resides on the memory bus, and can be located programmatically without any serious effort. In fact, in the case of the two cards we're considering here, it can only reside in one of two places, to wit, beginning at location zero of segment 0B000H for the Herc card and 0B800H for the colour card.

The contents of the screen memory translate into bit maps when these cards are in their graphics modes, so poking the appropriate bytes into the screen RAM at the appropriate places will draw pictures. This may be an oversimplification of a sort.

We'll be using the colour card in its highest resolution mode for these programs, that is, such that there are only two colours available. This makes both the code and the rationale behind it a lot simpler. It also means

that programs can be written to run on either of the two cards without modification using the functions in this feature. There are only minor differences in the resolution of the Herc card and the colour card in this mode for most practical purposes.

The first eight pixels on the high resolution screen are defined by the bits in the first byte of the screen buffer. The next eight are handled by the next byte and so on. This sounds delightfully simple... it's not. It works all right for the first line, either eighty or ninety bytes depending upon which card you're using. In the case of the colour card, however, the eighty first byte starts to get a bit tricky, as it actually lives on the third screen line. To access the second line, we use the address of the first line plus 8192. I never said it would be easy, just possible.

Under C, we can handle this with a standard expression. Given the X and Y coordinates of a pixel that we want to turn on, for example, the colour card formula for finding the appropriate byte is

$$(8192 * (y \% 2)) + (80 * (y / 2)) + (x / 8)$$

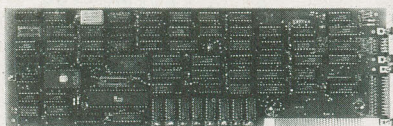
The expression is a bit different for the Herc card... you can see both variations in the *screen\_poke()* function in the accompanying code.

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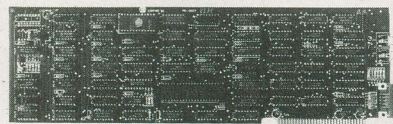
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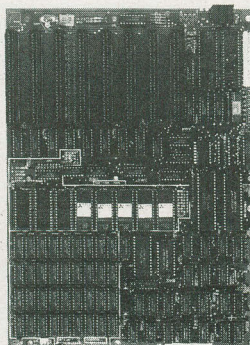
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```

/*      header file for zapdraw      */

#define true      1
#define false     0

#define HERCULES    false

#if    HERCULES
#define screen_base 0x0b000
#define screen_wide 720
#define screen_deep 348
#else
#define screen_base 0x0b800
#define screen_wide 640
#define screen_deep 200
#endif

#define pattern1    "\125\252\125\252\125\252\125\252"
#define pattern2    "\034\042\101\101\101\042\034\010"
#define pattern3    "\004\004\337\100\100\100\337\004"
#define pattern4    "\125\125\125\125\125\125\125\125"
#define pattern5    "\125\277\125\337\125\337\125\337"
#define pattern6    "\021\252\104\000\000\021\252\104"

typedef struct { int ax,bx,cx,dx,si,di; }    REG886;
typedef struct { int top,left,bottom,right; } RECT;
typedef struct { int x,y; }                POINT;
typedef char                                PATTERN[8];

```

Listing One: the header file.

# High Resolution Graphics in C

```

/*
ZapDraw - A sort of Mac-like graphics environment
for the PC. Written in Lattice C

version 1.0 - points, lines and rectangles module
copyright (c) 1986 steve rimmer

It's eight o'clock... do you know why your children are?

```

- contents -

```

*** Routines that work on rectangles
FrameRect()    draws a rectangular box
EraseRect()    erases contents of rectangle
PaintRect()    fills contents of rectangle with pattern
InvertRect()   inverts all the bits in the rectangle
SetRect()      defines a rectangle

```

```

*** Routines that work on lines
LineTo()       Draws a line from current cursor to (x,y)
MoveTo()       Sets current cursor position

```

```

*** Routines that work on points
SetPoint       Turns on a pixel
UnsetPoint     Turns off a pixel
InvertPoint    Flips a pixel
GetPoint       Returns the value of a pixel

```

```

*** Other stuff
ZapOn()        Initialize Zapdraw
ZapOff()       Deinitialize Zapdraw

```

```

*/

```

```

#include "stdio.h"
#include "zapdraw.h"

```

```

int CursorX = 0;
int CursorY = 0;
int PenX = 0;
int PenY = 0;

```

```

/* external callable routine - initialize zapdraw
*/

```

```

ZapOn()
{

```

```

    #if HERCULES
    graphics_mode();
    #else
    REGS86 r;

```

```

    r.ax = 0;
    int86(0x10,&r,&r);
    #endif

```

```

}
ZapOff()
{

```

```

    #if HERCULES
    text_mode();
    #else
    REGS86 r;

```

```

    r.ax = 3;
    int86(0x10,&r,&r);
    #endif

```

```

/* external callable routine - SetRect
sets up a rectangle with four args

```

```

*/

```

```

SetRect(f,t,l,b,r)
RECT *r;
int t,l,b,r;

```

```

{
    if (t < 0)
        t = 0;
    if (l < 0)
        l = 0;
    if (b > screen_deep)
        b = screen_deep;
    if (r > screen_wide)
        r = screen_wide;

```

```

    f->top = t;
    f->left = l;
    f->bottom = b;
    f->right = r;
}

```

```

/* external callable routine - FrameRect
draws a rectangle r of type RECT
doesn't change current pen position
*/

```

```

FrameRect(r)
RECT *r;

```

```

{
    RECT *r;
    int x,y;

    x = PenX;
    y = PenY;

    MoveTo(r->left,r->top);
    LineTo(r->right,r->top);
    MoveTo(r->right,r->bottom);
    LineTo(r->left,r->bottom);
    MoveTo(r->right,r->top);
    LineTo(r->right,r->bottom);
    MoveTo(r->left,r->bottom);
    LineTo(r->left,r->top);

```

```

    PenX = x;
    PenY = y;
}

```

```

/* external callable routine - InvertRect
inverts the contents of the rectangle r of type RECT
doesn't change current pen position
*/

```

```

InvertRect(r)
RECT *r;

```

```

{
    int y;

    for (y=r->top;y<=r->bottom;++y) {
        invert_Hline(r->left,y,r->right,y);
    }
}

```

```

/* external callable routine - EraseRect
erases the contents of the rectangle r of type RECT
doesn't change current pen position
*/

```

```

EraseRect(r)
RECT *r;

```

```

{
    register int y;

    for (y=r->top;y<=r->bottom;++y) {
        erase_Hline(r->left,y,r->right,y);
    }
}

```

Listing Two: the code.

## High Resolution Graphics in C

In order to set one pixel, then, we would read the byte of interest from the screen, turn on the appropriate bit in it and poke it back to the video RAM. The *SetPoint()* function shows how this is done, although the actual code may look a bit obtuse.

In looking at this function you'll encounter the first of several made up variable types, to wit, *POINT*. This thing is defined in the *zapdraw.h* file, and is actually a *struct* comprised of two *ints*. While this may seem a bit complicated, it has some very definite advantages in terms of the speed and efficiency of the code that will be used with these functions.

Every time you hand an argument to a function under C, the value of that argument must be pushed onto the stack and then popped off again. If you pass four arguments, this entails four pushes and four corresponding pops. This takes time, and slows things down. The idea in all this is to create the fastest graphics code possible.

Functions with lots of arguments are also messy, and prone to errors.

The way we'll be passing values to the functions of this code will be to load them into special structs and then simply pass pointers to the structs. Now, this may seem more complicated... and time consuming... but it has its advantages. To be sure, it takes more code to load a *POINT* variable and then pass it to *SetPoint()* than it would have to have passed the two arguments to this function as straight integers. However, if we wanted to make multiple calls to *SetPoint()* with the arguments changed arithmetically between each we would be able to deal with the struct elements as ints. For example, this code draws a line

```
POINT p;
p.y = 50;
for(p.x=10; p.x<100; ++p.x)
    SetPoint(&p);
```

In fact, this is not how we're going to be drawing lines most of the time, 'cause there's a faster way still.

Notice in this bit of code how the *POINT* variable is passed to *SetPoint()*. We don't pass the whole struct... which most C compilers won't do and the rest probably shouldn't... but, rather, we pass the address of the base of the struct with the *&* operator. This is important to remember... the compiler will complain mightily if you forget about it.

### The Hard Line

The most obvious way to draw lines is to do what we've just seen, that is, to plot pixels from the start to the finish. This is often what needs be done. Under a stock PC, however... not the fastest of beasts... this is

time consuming if we want to draw a lot of lines.

As we'll see, much of what we'll be doing with this code involves drawing horizontal lines, or portions thereof. Now, this actually represents a special case in line drawing, and we can cheat in this area to vastly improve the speed of the graphics code.

If you plot eight pixels in a horizontal line you've essentially filled the eight bits in a byte of the screen RAM... but you've done so labouriously, one bit at a time. It would have been a lot easier to have simply loaded the byte with *OFFH*, that is, all bits on. You can, as such, draw lines which start and end on even bytes by simply poking all the bytes on the line with *OFFH*.

The *Hline()* function in this code uses this cheat. It draws lines pixel by pixel until it comes to the start of an even byte, and then draws the line one byte at a time until it reaches the last full pixel. Finally, it plots the last few pixels individually.

As we'll see, this is used in a number of places around the code.

*In fact, this function is never called by external code. If you want to draw a line with these functions you would use MoveTo() to point to the start of the line and LineTo() to draw to the end. The first function sets the position of an invisible cursor, the pen, and the second does the actual drawing. This code checks to make sure that you aren't trying to draw off the screen.*

The *LineTo()* function decides which of three sorts of lines you want to draw. Horizontal and vertical lines are treated specially, because they can be drawn very quickly. Complex lines, those which are not horizontal or vertical, are handled by *Cline()*, which draws by approximating the path it's supposed to take as it goes. This sounds a bit funky, but it's the way that lines are usually drawn by computers.

Much of the code in this section has to do with rectangles. Rectangles are useful... they can box things in, and, as one gets more complicated, can manage windows and so on. Having devised a way to handle horizontal lines quickly, rectangles are the next logical step.

There are a number of things that one might want to do with rectangles. The most obvious function would be to draw one, for which we have *FrameRect()*. Yes, these are the same names as the Macintosh uses... I've rather gotten used to them. As with all the rectangle handlers, this function wants to be passed the address of a another special variable type called *RECT*. This is a struct which has four elements, to wit, *top*, *left*, *bottom* and *right*.

It being a bit tedious having to load these things by hand when their member count increases, there's a function called *SetRect()* to handle it all in one line. This bit of code draws a rectangle.

```
RECT r;
```

```
SetRect(&r,10,20,60,100);
FrameRect(&r);
```

The *SetRect()* function expects to see the last four arguments in the order *top*, *left*, *bottom* and *right*. It checks them to make sure that none of them attempt to place part of the rectangle beyond the edges of the screen, adjusting the contents of *r* if they do. This call would draw a box from (20,10) to (100,60).

In most situations, one loads a *RECT* once and then manipulates its contents as we did with the *POINT* variable above. If you want to optimize the speed of your programs... and you're loading up a lot of *RECT*s with unrelated values... you'll probably find that it's marginally faster to load the struct manually. It will, of course, create more lines of source code.

The *EraseRect()* function erases the contents of a rectangle. This means that it erases not only the frame drawn by *FrameRect()*, but everything inside it. I've never actually encountered a use for an *EraseFrameRect()* function, but it would be easy enough to write.

The *EraseRect()* function uses the horizontal line drawing routine we talked about before, of course. Even at that, it's not all that fast... it slows down notably on a regular PC if it's asked to invert large areas. It's really nice on the Best AVT-286 I wrote this stuff on, but this has it traveling at several times the speed of a muddy old 8088. I think that this is the best speed one can expect out of this sort of code.

The *InvertRect()* function flips every pixel in the rectangle it's handed. Again, this is done byte-wise for most of a large rectangle by simply *noting* the bytes read from the screen and stuffing them back. If you draw a rectangle with *FrameRect()* and invert it, it will appear to shrink by one pixel in every dimension, as you'll invert the frame into blackness.

The most complex rectangle function of this package is *PaintRect()*, which accepts both a *RECT* and a *PATTERN*, filling the first with the second. A *PATTERN* is actually an array of eight chars, or, for our purposes, eight bytes. This can also be thought of as a string. It's useful to treat it as such from time to time, as you can load a *PATTERN* with *strncpy()*. Make sure you only let this function copy right bytes, however.

A *PATTERN* is defined as eight bytes which, when stacked vertically on the screen, will form some sort of repeating texture. Actually, any eight bytes will do this. However, random ones can look a bit ghastly.

You can define any eight bytes you want in a *PATTERN*. I've set up six of them, called *pattern1* through *pattern6*, in the

# High Resolution Graphics in C

```
/* external callable routine - PaintRect
fills the rectangle r of type RECT with pattern p of type PATTERN
doesn't change current pen position
```

```
*/
PaintRect(r,p)
RECT r;
char *p;
{
    register int y;
    for (y=r->top; y<=r->bottom; ++y) {
        paint_Hline(r->left, y, r->right, y, p[y%8]);
    }
}
```

```
/* external callable routine - LineTo
draws a line from current pen position to x,y of type int
```

```
*/
LineTo(x,y)
int x,y;
{
    int xs,ys,xs,ys;

    if (x > PenX) {
        xs = PenX;
        xe = x;
    }
    else {
        xe = PenX;
        xs = x;
    }

    if (y > PenY) {
        ys = PenY;
        ye = y;
    }
    else {
        ye = PenY;
        ys = y;
    }

    if (xs < 0) {
        xs = 0;
    }
    if (ys < 0) {
        ys = 0;
    }
    if (xe > screen_wide) {
        xe = screen_wide;
    }
    if (ye > screen_deep) {
        ye = screen_deep;
    }

    if (PenY == y) {
        Hline(xs,ys,xs,ys);
    }
    else if (PenX == x) {
        Vline(xs,ys,xs,ys);
    }
    else {
        Cline(xs,ys,xs,ys);
    }
}
```

```
/* external callable routine - MoveTo
moves the current pen position to x,y of type int
```

```
*/
MoveTo(x,y)
int x,y;
{
    PenX = x;
    PenY = y;
}
```

```
/* external callable routine - SetPoint
sets the pixel at x,y of type int
```

```
*/
SetPoint(p)
POINT *p;
{
    screen_poke(screen_peek(p->x/8,p->y)
        & (1 << (7 - (p->x % 8))), p->x/8, p->y);
}
```

```
/* external callable routine - UnsetPoint
unsets the pixel at p of type point
```

```
*/
UnsetPoint(p)
POINT *p;
{
    screen_poke(screen_peek(p->x/8,p->y)
        & (1 << (7 - (p->x % 8))), p->x/8, p->y);
}
```

```
/* external callable routine - InvertPoint
inverts the pixel at p of type point
```

```
*/
InvertPoint(p)
POINT *p;
{
    screen_poke(screen_peek(p->x/8,p->y)
        ^ (1 << (7 - (p->x % 8))), p->x/8, p->y);
}
```

```
/* external callable routine - GetPoint
returns the pixel at p of type point
0 = off, not zero = on
```

```
*/
GetPoint(p)
POINT *p;
{
    return(screen_peek(p->x/8,p->y)
        & (1 << (7 - (p->x % 8))), p->x/8, p->y);
}
```

```
/*
---- internal routines ----
*/
```

```
screen_poke(i,x,y) /* poke i to the screen at x,y */
int i,x,y;
{
    char c[i];
    *c = i;
    #if HERCULES
    poke(screen_base, (0x02000 * (y % 4)) + (90 * (y/4)) + x, c, 1);
    #else
    poke(screen_base, (8192 * (y % 2)) + (80 * (y/2)) + x, c, 1);
    #endif
}
```

```
screen_peek(x,y) /* peek screen at x,y */
int x,y;
```

```
{
    char c[1];
    #if HERCULES
    peek(screen_base, (0x02000 * (y % 4)) + (90 * (y/4)) + x, c, 1);
    #else
    peek(screen_base, (8192 * (y % 2)) + (80 * (y/2)) + x, c, 1);
    #endif
    return((int)*c);
}
```

```
Hline(xs,ys,xs,ys) /* internal routine - horizontal line */
int xs,ys,xs,ys;
```

```
{
    int i;
    POINT p;
```

# High Resolution Graphics in C

```

i = xs;
while (i <= xe) {
    if (((xe-i) >= 8) && ((i%8) == 0)) {
        screen_poke(255,i/8,ys);
        i += 8;
    }
    else {
        p.x = i;
        p.y = ys;
        SetPoint(&p);
        ++i;
    }
}

/* internal routine - vertical line */
Vline(xs,ys,xs,ye)
int xs,ys,xs,ye;
{
    int i;
    POINT p;

    for (i=ys; i<=ye; ++i) {
        p.x = xs;
        p.y = i;
        SetPoint(&p);
    }
}

/* internal routine - diagonal line */
Cline(xs,ys,xs,ye)
int xs,ys,xs,ye;
{
    int x,y;
    int d;
    int i,j;
    POINT p;

    x = xe - xs;
    y = ye - ys;

    p.x = xs;
    p.y = ys;

    if (x > y) {
        i = y << 1;
        d = i - x;
        j = i - (x << 1);

        while (p.x != xe) {
            ++p.x;
            if (d < 0) {
                d += i;
            }
            else {
                ++p.y;
                d += j;
            }
            SetPoint(&p);
        }
    }
    else {
        i = x << 1;
        d = i - y;
        j = i - (y << 1);

        while (p.y != ye) {
            ++p.y;
            if (d < 0) {
                d += i;
            }
            else {
                ++p.x;
                d += j;
            }
            SetPoint(&p);
        }
    }
}

```

```

/* internal routine - invert horizontal line */
invert_Hline(xs,ys,xs,ye)
int xs,ys,xs,ye;
{
    int i;
    i = xs;
    while (i <= xe) {
        if (((xe-i) >= 8) && ((i%8) == 0)) {
            screen_poke(~screen_peek(i/8,ys),i/8,ys);
            i += 8;
        }
        else {
            p.x = i;
            p.y = ys;
            InvertPoint(&p);
            ++i;
        }
    }
}

/* internal routine - erase horizontal line */
erase_Hline(xs,ys,xs,ye)
int xs,ys,xs,ye;
{
    int i;
    POINT p;

    i = xs;
    while (i <= xe) {
        if (((xe-i) >= 8) && ((i%8) == 0)) {
            screen_poke(0,i/8,ys);
            i += 8;
        }
        else {
            p.x = i;
            p.y = ys;
            UnsetPoint(&p);
            ++i;
        }
    }
}

/* internal routine - paint horizontal line */
paint_Hline(xs,ys,xs,ye,f)
int xs,ys,xs,ye,f;
{
    int i;
    POINT p;

    i = xs;
    while (i <= xe) {
        if (((xe-i) >= 8) && ((i%8) == 0)) {
            screen_poke(f,i/8,ys);
            i += 8;
        }
        else {
            p.x = i;
            p.y = ys;
            if (f && 1 << (i%8)) {
                SetPoint(&p);
            }
            else {
                UnsetPoint(&p);
            }
            ++i;
        }
    }
}

```

## High Resolution Graphics in C

header file. This bit of code would fill a rectangle with a pattern.

```
RECT r;
PATTERN p;

SetRect(&r,10,5,40,50);
strcpy(p,pattern3,8);
PaintRect(&r,p);
```

There are a few things that are probably worth noting about the patterns one uses with this function. Colour cards... especially the cheap ones that come with some compatible machines... are a bit funky in their highest resolution modes. The images they display can come up a bit fuzzy and, as such, complicated patterns often look more or less like filled in areas. This is especially important if you write code which is developed on a Herc card... which has much better resolution... and is subsequently recompiled for a colour card.

### Crowning Glories

There are a few other things you'll need to know about this code. The first function you should put in your program is *ZapOn()*, which will put the computer in its graphics mode and initialize the package. The last one is *ZapOff()*, which will return you to text

mode. This latter call will, in fact, return you to the eighty column text mode... if you want something else you should change the modes after you execute *ZapOff()*.

If you want to use this program with the Herc card, you'll have to link the HERCINIT.OBJ module to your programs as well as this code to keep the linker happy. This can be found in the "Labours of Hercules" feature in the April 1986 edition of *Computing Now!*.

This chunk of code can be compiled to run with either the Hercules card or the colour card but not both. You can decide which you want it to run with by setting one of the two appropriate equates in the header file true. Having written a program for one card, simply change the equate and recompile this code and your program will produce a working version for the other.

Actually, this is mostly true. In writing a program to run on both cards you have to make sure to restrict your graphics to the size of the colour card, or write code which knows the difference.

It would have been possible to have written the *screen\_peek()* and *screen\_poke()* functions to have decided which card was in the system and run with whichever one was appropriate... in fact, initially this is how the program did work. The only catch in

this is that it slows things down quite a lot, inasmuch as the screen manipulation routines have to decide which card is on line every time you want to change something on the screen.

In order to use this code, you would compile this module and wind up with ZAPDRAW.OBJ. Programs which were to use the functions in this code would then be linked to it... a typical line might be

```
LINK CC + ZAPDRAW + HERCINIT + MYCODE
```

In reality, of course, one usually uses a batch to handle these things... just add the appropriate object modules to the link line in your file.

Once you've figured how to manipulate the graphics screen of a PC at a reasonable speed, you can get some fairly sophisticated things together. In the case of the Hercules card, it's quite desirable to write even text based applications for it to run in graphics mode, as one can get more characters on a line of the graphics screen than one can in text mode, as well as having the ability to draw charts and boxes wherever one fancies them. This high speed graphics interface makes it practical to handle such things from C without a lot of low level hacking.

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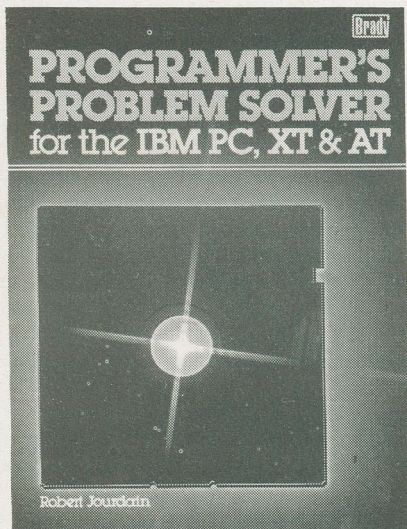
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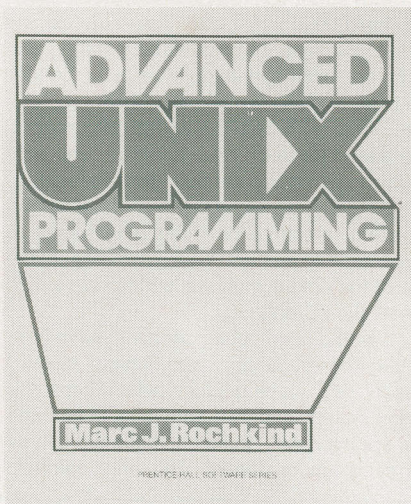
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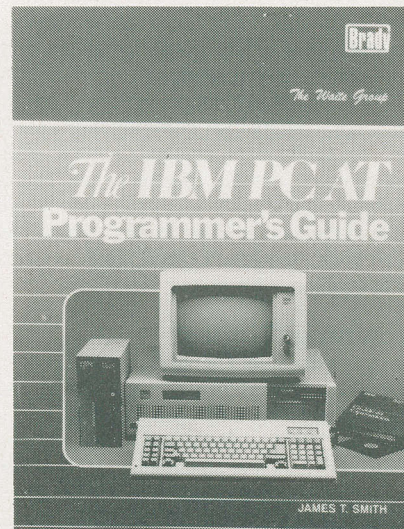
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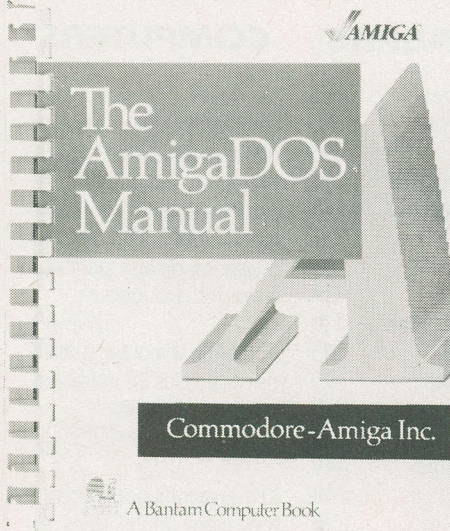


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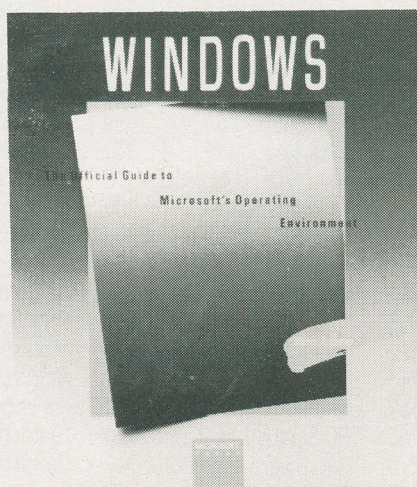
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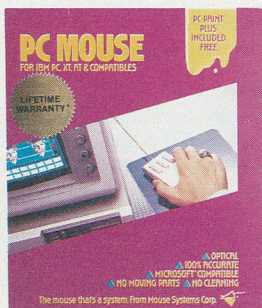
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## brother M-1109 DOT MATRIX PRINTER



An extremely light and compact printer, capable of a quick 100 cps in draft mode and 25 cps in NLQ mode. The M-1109 comes equipped with both Centronics Parallel and RS-232C serial interfaces.

Compatibility with IBM PC & EPSON FX-80+ along with download character and high density graphics printing assures the capability of working with the most popular microcomputers and Software.

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# COMPUTER PRESS

## C! C! Senor!

● C86PLUS C compiler from *Computer Innovations* applies artificial intelligence techniques to produce **highly optimized code**, very fast execution speed and compatibility with MS-C code and Unix System V functions. Taking advantage of powerful hardware architectures such as Intel's 80286 and 80386 microprocessors, it requires a hard disk and 512K memory. The price is just shy of five hundred dollars American.

Computer Innovations can be reached at 980 Shrewsbury Avenue, Tinton Falls, New Jersey 07724, or by calling (201) 542-5920.

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● The latest release of Bastoc, a **BASIC to C translator/compiler**, supports both Microsoft and Lattice C compilers, and includes a SHELL statement allowing a BASIC program to issue DOS, Unix or Xenix commands. In addition, Bastoc provides record locking support and printer spooling control.

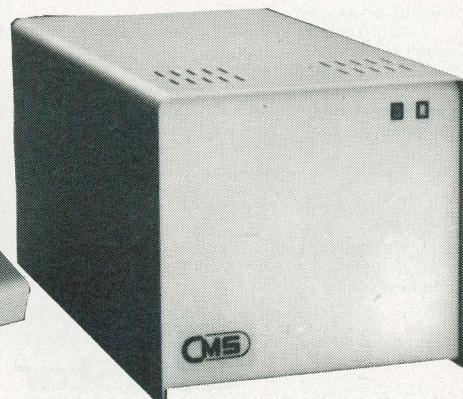
Just under five hundred dollars American, you can get it directly from *JMI Software Consultants*, 904 Sheble Lane, Box 481, Spring House, Pennsylvania 19477, or call them at (215) 628-0846.

## MacMore And MacMore

● A standalone data acquisition peripheral, the IDAC/1000, works over a standard RS-232C port at speeds up to 19.2K, has a 32K firmware operating system and will capture eight channels of single-ended or four channels of differential analogue input. A complete systems package, including Macontrol data acquisition software, or Icontrol for the IBM PC, will cost just under eighteen hundred American dollars from *International Data Acquisition & Control*, Four Limbo Lane, P.O. Box 397, Amherst, New Hampshire 03031, telephone (603) 673-0765.



● The S-220, an external hard drive for the Mac Plus, employs two 20 Mb, half-height 5.25 inch drives allowing it to be used as a backup system as well. Using embedded SCSI drivers, an optional SCSI interface card will allow it to function with the Apple IIe and new IIs. The list price will be \$1,600 US from *CMS*, 3080-A Airway, Costa Mesa, California 92626, telephone (714) 549-9111.



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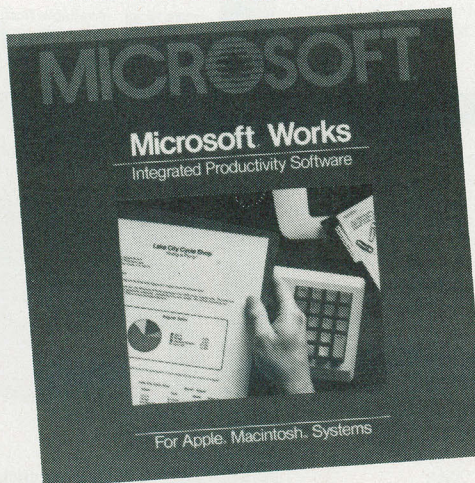
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● LogicWorks, an interactive, **digital circuit design** and testing program has added user-defined devices, logic arrays and complex timing sequence input to the popular LogiMac program it's based on. Costing \$260, or \$125 for the Amiga version, you can get it from *Capilano Computing Systems*, P.O. Box 86971, North Vancouver, British Columbia V7L 4P6, telephone (604) 669-6343.

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● Combining word processor, spreadsheet with graphics, database and a communications module, *Microsoft's* Works package for the Macintosh is intended for the **first time business computer user** who performs a variety of general business tasks. Requiring either a 512K Mac or a Mac Plus, the package will cost \$430, and is available from authorized Microsoft dealers; for the one nearest you, call Microsoft Canada at (416) 673-7638.

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## Latest Lattice

Adding more than one hundred functions to the standard library, **AmigaDOS C Compiler version 3.10** also features faster pointer and integer math and multi-tasking support. This two disk package includes a full macro assembler, librarian and linker, and will cost \$225 US; upgrades are also available.

For more information, contact *Lattice* at P.O. Box 3072, Glen Ellyn, Illinois 60138, or call them at (312) 858-7950.

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## Taking Samples

*E-mu Systems* recently introduced the Emax **digital sampling keyboard** specifically designed for the semi-professional and serious amateur musician. Featuring a ten disk library of sound samples, stereo output, pressure-sensitive keyboard and variable sampling rate, Emax comes with a 3 1/2 inch microfloppy drive, RS-232C port, multitrack MIDI sequencer and a full-featured arpeggiator.

With a suggested list price of \$2,895 US, Emax is available from *E-mu Systems*, P.O. Box 66303, 1600 Green Hills Road, Scotts Valley, California 95066, telephone (408) 438-1921.

## Quick Prints

Two new **dot matrix printers** in the Fortis line from *Dynax* produce print speeds up to 200 cps in draft mode, and 50 cps in near letter quality, and are capable of resolutions up to 240 dpi in a variety of graphics modes. The DM2010 will cost \$875, while the wide-carriage DM2015 will be \$1,035. Both are available from *Gentek Marketing*, 175 Jardin Drive, Unit 2, Concord, Ontario L4K 1X5, or call them at (416) 738-9300.

Circle No. 36 on Reader Service Card **CNI**

You can only get out of colour monitors, what technology puts into them. So if they are to match the performance characteristics of your system, your choice of monitors is critical.

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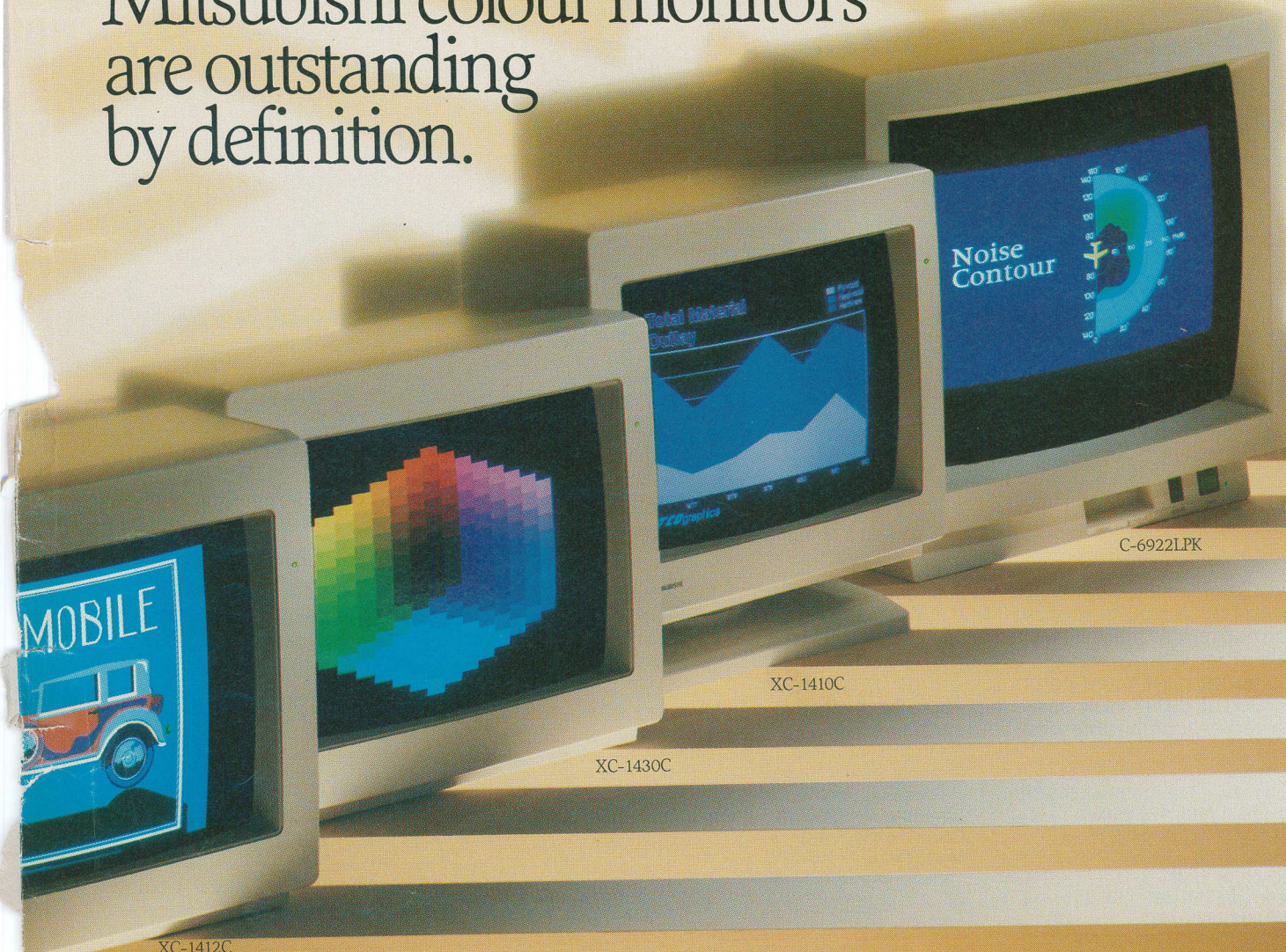


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